

# SPACE SHUTTLE MISSIONS SUMMARY

*Robert D. Legler  
Floyd V. Bennett*

*Mission Operations  
Johnson Space Center*



## THE NASA STI PROGRAM OFFICE . . . IN PROFILE

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program Office plays a key part in helping NASA maintain this important role.

The NASA STI Program Office is operated by Langley Research Center, the lead center for NASA's scientific and technical information. The NASA STI Program Office provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program Office is also NASA's institutional mechanism for disseminating the results of its research and development activities. These results are published by NASA in the NASA STI Report Series, which includes the following report types:

- **TECHNICAL PUBLICATION.** Reports of completed research or a major significant phase of research that present the results of NASA programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA's counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- **CONTRACTOR REPORT.** Scientific and technical findings by NASA-sponsored contractors and grantees.

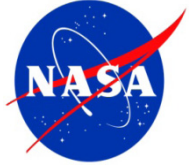
- **CONFERENCE PUBLICATION.** Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or cosponsored by NASA.
- **SPECIAL PUBLICATION.** Scientific, technical, or historical information from NASA programs, projects, and mission, often concerned with subjects having substantial public interest.
- **TECHNICAL TRANSLATION.** English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services that complement the STI Program Office's diverse offerings include creating custom thesauri, building customized databases, organizing and publishing research results . . . even providing videos.

For more information about the NASA STI Program Office, see the following:

- Access the NASA STI Program Home Page at <http://www.sti.nasa.gov>
- E-mail your question via the internet to [help@sti.nasa.gov](mailto:help@sti.nasa.gov)
- Fax your question to the NASA Access Help Desk at (301) 621-0134
- Telephone the NASA Access Help Desk at (301) 621-0390
- Write to:  
NASA Access Help Desk  
NASA Center for AeroSpace Information  
7115 Standard  
Hanover, MD 21076-1320





# SPACE SHUTTLE MISSIONS SUMMARY

*Robert D. Legler  
Floyd V. Bennett*

*Mission Operations  
Johnson Space Center*



Available from:

NASA Center for AeroSpace Information  
7115 Standard Drive  
Hanover, MD 21076-1320  
301-621-0390

National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
703-605-6000

This report is also available in electronic form at <http://ston.jsc.nasa.gov/collections/TRS/>

## MOD EMBLEM



### MOD EMBLEM DESCRIPTION

This emblem was developed during the Apollo program for the mission control team [JSC Mission Operations Directorate, MOD] to recognize their unique contribution to manned space flight since the Mercury program.

The sigma ( $\Sigma$ ) represents the total mission team, including flight controllers, instructors, flight design and production specialists, and facility development and support teams including all engineering, scientific, operations disciplines, and supporting tasks.

The Shuttle launch represents the dynamic elements of space, the initial escape from our environment, and the thrust to explore the universe. The four stars on the Shuttle's plume represent the basic principles of the Mission Operations team: discipline, morale, toughness, and competence. Their place along the Shuttle's plume reminds us that they are the foundation upon which each mission is flown. Today's core principles include confidence, responsibility, teamwork, and vigilance. Each of these words comes into the vocabulary of Mission Operations personnel at critical points in their development. These words can never be forgotten if we are to succeed in the future.

The orbiting International Space Station symbolizes a permanent human presence in space, conducting research and developing materials leading to the commercial utilization of the space environment.

The Earth is our home and will forever be serviced by both manned and unmanned spacecrafts in order to improve our quality of life. A single star is positioned over Houston, the home of U.S. human spaceflight operations.

The comet represents those individuals who have given their lives for space exploration. The seventeen stars represent our fallen astronauts, to whom in part we dedicate our commitment to excellence. These symbols serve as a reminder of the risks inherent to space flight and recognize that we of Mission Operations provide the margin that makes the risk acceptable.

The Mercury, Gemini, Apollo, Skylab, and Apollo-Soyuz Test are represented on the bottom border. At the top of the emblem, the Moon and Mars represent our future, signifying our intent to lead the way.

The wording "RES GESTA PER EXCELLENTIAM" - "Achieve through Excellence" - is the standard for our work. It represents an individual's commitment to a belief, to craftsmanship, and to perseverance, qualities required to continue the peaceful development of space and the quest for the stars.

The original emblem was designed (at the request of White Flight, Gene Kranz) by Robert T. McCall in April 1973 and bears the inscription "For the Personnel of Mission Control with Great Respect and Admiration. Robert T. McCall." Mr. McCall died at age 90, May 5, 2010. In 1983, the original emblem was updated to support the Space Shuttle program. In 2004, with the artistic help of graphic designer Mike Okuda and participation of the Mission Operations team, the emblem was updated to recognize the achievements and contributions of the team supporting the International Space Station program as well as those that contributed to the success of the earlier Skylab and Apollo-Soyuz Test Project missions.

## ABSTRACT

This document was originally produced as an informal Mission Operations book and has been updated since Space Shuttle Flight STS-1 and throughout the program. This version is a formally released NASA document. It is a handy reference guide for flight data for all Space Shuttle missions. “As-flown” data is provided as compiled from many flight support sources for ascent, on-orbit events, and descent mission phases. In addition, the specific shuttle vehicle configuration, payload, flight crew, and flight directors are

identified for each flight. In the development of this book, the data for the early flights are contained on a single page per flight. For later flights, more pages per flight have been added, primarily for growth in mission complexity as noted in the “Mission Highlights” data column. This particularly applies to missions involved in the assembly of the International Space Station. Pertinent photos for each mission are also included on each mission summary page.

## FOREWORD

### *THE REUSABLE SPACE SHUTTLE*

The Space Shuttle Vehicle (SSV) was the world's first reusable Spacecraft. It consisted of a reusable Orbiter Vehicle with three Space Shuttle Main Engines (SSMEs), two Solid Rocket Boosters (SRBs), and an expendable External Tank (ET). The Space Shuttle System consisted of the SSV elements, Shuttle Carrier aircraft, payload accommodations, and ground support systems. The SSV was designed to perform a variety of missions to low Earth orbit with heavy payload lift capability.

SSV missions included: Manned payload bay laboratory science, deployment and servicing of payloads, and special support to space activities such as sortie missions (rescue, repair, maintenance servicing, assembly, and docking), and International Space Station (ISS) assembly, manning, and support including robotic and manned extra vehicular activities.

The SSV was flown for 30 years from 1981 to 2011. Brief mission summaries for each of these missions are provided in this document. The document contains “as flown” mission data and pertinent photographs for each flight. It was originally published as an informal document and routinely updated throughout the Shuttle era.



ABOVE: S81-30498 --- After six years of silence, the thunder of U.S. manned spaceflight is heard again, as the successful launch of the first Space Shuttle reusable vehicle, Columbia, ushers in a new concept in utilization of space - April 12, 1981.

RIGHT: Thirty years later on STS-135, the Atlantis vehicle executes the final Space Shuttle landing on July 21, 2011 at KSC. With the closure of the Space Shuttle Program, the thunder of U.S. manned spaceflight is not expected to be heard again for another several years.



## FOREWORD (Continued...)

### ----- SPACE SHUTTLE THOUGHTS -----

#### The Space Shuttle--1981 to 2011

The Space Transportation System-STS-has had a spectacular career spanning three decades of intense and productive activities in space. The Shuttle was conceived as a reusable launch system to grossly reduce the cost of transporting humans and satellites into low earth orbit and to service the entire spectrum of government and commercial space operations requirements. To accomplish this challenging task required the development of a series of new technologies in rocket engines, space systems, unique materials, highly advanced manufacturing techniques, autonomous control concepts and never before attempted flight operations maneuvers. The fact that these devices were conceived and developed and in almost all cases could be reused is a testimony to the marvelous capability of the US and allied aerospace community.

Equally significant was the ability of the government industry team to bring about the successful development of this phenomenal machine under the stringent and ever changing and fickle government budgetary process. The management team was required to continuously adjust the expenditure of funds because of both postponement and reductions in national budget that resulted in a delay in manufacturing facilities, extended testing periods and technology development which presented extraordinary circumstances regarding the ability to arrive at the first flight of the Shuttle. And although the first and subsequent STS flights were delayed by several years, the cost to build the transportation system was reasonably close to the original cost estimates. Indeed, if the effects of inflation are included, the overall cost of the program was probably within the costs estimates made almost ten years previously.

There were two devastating fatal accidents during the course of the STS time period. It should be noted that both of these accidents took place because of mismanagement. The accidents literally destroyed the user confidence in the STS and resulted in the eventual termination of the Shuttle. The Space Shuttle without these two unnecessary failures is an extremely safe space faring vehicle and it will be a long time in the future before a reusable rocket caring humans will match this accomplishment.

An overall assessment of the STS must say that history will show the accomplishments were spectacular.

Christopher C. Kraft, Jr.  
First Flight Director



I look at the three decades of Space Shuttle flights with a great deal of pride. John Young and I had the privilege of flying Columbia on the initial orbital test flight. While the Shuttle didn't live up to some of the preflight hype regarding flight rate and cost, it still is the most fantastic spaceship ever built and likely will be for the foreseeable future. Yes, we had two terrible tragedies, but spaceflight is not without risk now and for the foreseeable future.

The Shuttle has accomplished many wondrous feats in its 30 years of flight. In the beginning it flew very important DOD missions that I believe played a major role in the winning of the Cold War. The payloads it has taken to orbit have revolutionized knowledge of our solar system and the universe. The Shuttle Program made possible the construction of the unbelievably complex International Space Station.

All in all, everyone associated with the Shuttle should be proud of what the program accomplished. It will be a very long time before we see a spaceship with anywhere near the Shuttle's capability.

Bob (Crip) Crippen  
PLT STS-1, and CDR STS-7, STS-41C & STS-41g  
KSC Center Director 1992 - 1995



Continued...



## FOREWORD (Continued...)

### ----- SPACE SHUTTLE THOUGHTS-----

#### National Space Transportation System (Space Shuttle)

Developed primarily in the 1970's, the National Space Transportation System (Space Shuttle) was, and remains to this day, the most innovative and capable human rated space launch system created by man.

As much as Apollo, the Space Shuttle established the United States as the human space flight technology leader of the world, made human access to low-Earth orbit (LEO) relatively routine, and raised the expectations of the global population in regards to the value of space to mankind. It has enabled us to learn to live and work in space to create value on Earth.

The Shuttle designers both advanced the state of technology by levying seemingly unachievable technical challenges, such as the incredibly high power density Space Shuttle Main Engine (SSME), complex redundant data processing, and reusable thermal protection systems, as well as utilizing available technology like aluminum structure and hydraulic flight control and thrust vector control systems.



The Shuttle designers both advanced the state of technology by levying seemingly unachievable technical challenges, such as the incredibly high power density Space Shuttle Main Engine (SSME), complex redundant data processing, and reusable thermal protection systems, as well as utilizing available technology like aluminum structure and hydraulic flight control and thrust vector control systems.

By advancing the state of the art in mission planning and execution, the Shuttle team took maximum advantage of the extensive capabilities available from both man and machine and the synergistic interplay between them. The results in mission accomplishments are undeniable and have forever transformed our understanding of the world in which we live.

Brewster H. Shaw, Jr.  
PLT STS-9 and CDR STS-61B & STS- 28  
Space Shuttle Program Mgr 1993 -1995  
VP & GM Space Exploration Boeing Houston

# TABLE OF CONTENTS

| TITLE               | PAGE | LAUNCH DATE | TITLE  | PAGE | LAUNCH DATE | TITLE       | PAGE  | LAUNCH DATE | TITLE          | PAGE  | LAUNCH DATE | TITLE                | PAGE  | LAUNCH DATE |
|---------------------|------|-------------|--------|------|-------------|-------------|-------|-------------|----------------|-------|-------------|----------------------|-------|-------------|
| MOD EMBLEM          | i    |             | STS-29 | 2-30 | 03/13/89    | STS-59      | 2-74  | 04/09/94    | STS-103        | 2-119 | 12/19/99    | STS-130/20A          | 2-221 | 02/08/10    |
| ABSTRACT            | ii   |             | STS-30 | 2-32 | 05/04/89    | STS-65      | 2-75  | 07/08/94    | STS-99         | 2-121 | 02/11/00    | STS-131/19A          | 2-225 | 04/05/10    |
| FOREWORD            | iii  |             | STS-28 | 2-33 | 08/08/89    | STS-64      | 2-76  | 09/09/94    | STS-101/2A.2a  | 2-123 | 05/19/00    | STS-132/ULF4         | 2-229 | 05/14/10    |
| TABLE OF CONTENTS   | vi   |             | STS-34 | 2-34 | 10/18/89    | STS-68      | 2-77  | 09/30/94    | STS-106/2A.2b  | 2-125 | 09/08/00    | STS-133/ULF5         | 2-234 | 02/24/11    |
| ACRONYMS            | vii  |             | STS-33 | 2-35 | 11/22/89    | STS-66      | 2-78  | 11/03/94    | STS-92/3A      | 2-127 | 10/11/00    | STS-134/ULF6         | 2-240 | 05/16/11    |
| ABOUT THIS DOCUMENT | 1-1  |             | STS-32 | 2-36 | 01/09/90    | STS-63      | 2-79  | 02/03/95    | STS-97/4A      | 2-130 | 11/30/00    | STS-135/ULF7         | 2-246 | 07/08/11    |
| STS-1               | 2-1  | 04/12/81    | STS-36 | 2-38 | 02/28/90    | STS-67      | 2-81  | 03/02/95    | STS-98/5A      | 2-132 | 02/07/01    | Weight Summary       | A-1   |             |
| STS-2               | 2-2  | 11/12/81    | STS-31 | 2-39 | 04/24/90    | STS-71      | 2-83  | 06/27/95    | STS-102/5A.1   | 2-134 | 03/08/01    | Acknowledgements     | B-1   |             |
| STS-3               | 2-3  | 03/22/82    | STS-41 | 2-40 | 10/06/90    | STS-70      | 2-85  | 07/13/95    | STS-100/6A     | 2-136 | 04/19/01    | Flight Director Log  | C-1   |             |
| STS-4               | 2-4  | 06/27/82    | STS-38 | 2-41 | 11/15/90    | STS-69      | 2-86  | 09/07/95    | STS-104/7A     | 2-138 | 07/12/01    | Authors              |       |             |
| STS-5               | 2-5  | 11/11/82    | STS-35 | 2-43 | 12/02/90    | STS-73      | 2-87  | 10/20/95    | STS-105/7A.1   | 2-140 | 08/10/01    | Legler (in Memoriam) | IM-1  |             |
| STS-6               | 2-6  | 04/04/83    | STS-37 | 2-45 | 04/05/91    | STS-74      | 2-88  | 11/12/95    | STS-108/UF-1   | 2-142 | 12/05/01    | Bennett              | SA-1  |             |
| STS-7               | 2-7  | 06/18/83    | STS-39 | 2-47 | 04/28/91    | STS-72      | 2-89  | 01/11/96    | STS-109        | 2-144 | 03/01/02    |                      |       |             |
| STS-8               | 2-8  | 08/30/83    | STS-40 | 2-48 | 06/05/91    | STS-75      | 2-90  | 02/22/96    | STS-110/8A     | 2-146 | 04/08/02    |                      |       |             |
| STS-9               | 2-9  | 11/28/83    | STS-43 | 2-49 | 08/02/91    | STS-76      | 2-91  | 03/22/96    | STS-111/UF-2   | 2-148 | 06/05/02    |                      |       |             |
| STS-11 (41-B)       | 2-10 | 02/03/84    | STS-48 | 2-50 | 09/12/91    | STS-77      | 2-93  | 05/19/96    | STS-112/9A     | 2-151 | 10/07/02    |                      |       |             |
| STS 41-C            | 2-11 | 04/06/84    | STS-44 | 2-51 | 11/24/91    | STS-78      | 2-94  | 06/20/96    | STS-113/11A    | 2-154 | 11/23/02    |                      |       |             |
| STS 41-DR           | 2-12 | 08/30/84    | STS-42 | 2-52 | 01/22/92    | STS-79      | 2-95  | 09/16/96    | STS-107        | 2-157 | 01/16/03    |                      |       |             |
| STS 41-G            | 2-13 | 10/05/84    | STS-45 | 2-53 | 03/24/92    | STS-80      | 2-97  | 11/19/96    | STS-114/LF1    | 2-159 | 07/26/05    |                      |       |             |
| STS 51-A            | 2-14 | 11/08/84    | STS-49 | 2-54 | 05/07/92    | STS-81      | 2-98  | 01/12/97    | STS-121/ULF1.1 | 2-163 | 07/04/06    |                      |       |             |
| STS 51-C            | 2-15 | 01/24/85    | STS-50 | 2-56 | 06/25/92    | STS-82      | 2-99  | 02/11/97    | STS-115/12A    | 2-166 | 09/09/06    |                      |       |             |
| STS 51-E            | 2-16 | N/A         | STS-46 | 2-58 | 07/31/92    | STS-83      | 2-101 | 04/04/97    | STS-116/12A.1  | 2-170 | 12/09/06    |                      |       |             |
| STS 51-D            | 2-17 | 04/12/85    | STS-47 | 2-60 | 09/12/92    | STS-84      | 2-102 | 05/15/97    | STS-117/13A    | 2-174 | 06/08/07    |                      |       |             |
| STS 51-B            | 2-18 | 04/29/85    | STS-52 | 2-61 | 10/22/92    | STS-94      | 2-103 | 07/01/97    | STS-118/13A.1  | 2-178 | 08/08/07    |                      |       |             |
| STS 51-G            | 2-19 | 06/17/85    | STS-53 | 2-62 | 12/02/92    | STS-85      | 2-104 | 08/07/97    | STS-120/10A    | 2-182 | 10/23/07    |                      |       |             |
| STS 51-F            | 2-20 | 07/29/85    | STS-54 | 2-63 | 01/13/93    | STS-86      | 2-105 | 09/25/97    | STS-122/1E     | 2-185 | 02/07/08    |                      |       |             |
| STS 51-I            | 2-21 | 08/27/85    | STS-56 | 2-64 | 04/08/93    | STS-87      | 2-107 | 11/19/97    | STS-123/1JA    | 2-189 | 03/11/08    |                      |       |             |
| STS 51-J            | 2-22 | 10/03/85    | STS-55 | 2-65 | 04/26/93    | STS-89      | 2-108 | 01/22/98    | STS-124/1J     | 2-193 | 05/31/08    |                      |       |             |
| STS 61-A            | 2-23 | 10/30/85    | STS-57 | 2-66 | 06/21/93    | STS-90      | 2-109 | 04/17/98    | STS-126/ULF2   | 2-198 | 11/14/08    |                      |       |             |
| STS 61-B            | 2-24 | 11/26/85    | STS-51 | 2-68 | 09/12/93    | STS-91      | 2-110 | 06/02/98    | STS-119/15A    | 2-201 | 03/15/09    |                      |       |             |
| STS 61-C            | 2-25 | 01/12/86    | STS-58 | 2-69 | 10/18/93    | STS-95      | 2-111 | 10/29/98    | STS-125        | 2-205 | 05/11/09    |                      |       |             |
| STS 51-L            | 2-27 | 01/28/86    | STS-61 | 2-70 | 12/02/93    | STS-88/2A   | 2-113 | 12/04/98    | STS-127/2JA    | 2-209 | 07/15/09    |                      |       |             |
| STS-26              | 2-28 | 09/29/88    | STS-60 | 2-72 | 02/03/94    | STS-96/2A.1 | 2-115 | 05/27/99    | STS-128/17A    | 2-213 | 08/29/09    |                      |       |             |
| STS-27              | 2-29 | 12/02/88    | STS-62 | 2-73 | 03/04/94    | STS-93      | 2-117 | 07/23/99    | STS-129/ULF3   | 2-217 | 11/16/09    |                      |       |             |



# ACRONYM LIST

|               |   |              |   |
|---------------|---|--------------|---|
| AIM PT        | AIM POINT   | MPS          | MAIN PROPULSION SYSTEM                  |
| AL            | ASCENDING LEFT                                      | MRN          | MORON                                   |
| AOA           | ABORT ONCE AROUND                                   | M/S          | MISSION SPECIALIST                      |
| AR            | ASCENDING RIGHT                                     | MTR          | MOTOR                                   |
| ASC           | ASCENT  | N            | NOMINAL                                 |
| ASC/ENT       | ASCENT/ENTRY  | NEG RET      | NEGATIVE RETURN                         |
| AVE BRK DECEL | AVERAGE BRAKE DECELERATION                          | NLGTD        | NOSE LANDING GEAR TOUCHDOWN             |
|               |   | 01, 02, 03   | ORBIT 1, 2, OR 3 FLIGHT DIRECTOR SHIFTS |
| BEN           | BEN GUERIRBRK INIT BRAKE INITIATION VELOCITY IN KGS | OFT          | OFFICIAL FLIGHT DESIGNATOR              |
| BR/UP         | BREAK UP ALTITUDE OF ET                             | OI           | OPERATIONAL INCREMENT                   |
|               | IN THOUSANDS OF FEET                                | OMS          | ORBITAL MANEUVERING SYSTEM              |
| BYD           | BANJUL  | OPF          | ORBITER PROCESSING FACILITY             |
|               |   | ORB DIR      | ORBIT DIRECTION                         |
| CI            | CLOSEIN   | P            | SEQUENTIAL NUMBER OF PERSON FLOWN ON SS |
| CTOB          | CREW TIME ON BACK                                   | PAO          | PUBLIC AFFAIRS OFFICE                   |
|               |   | PERF         | PERFORMANCE                             |
| DENS ALT      | DENSITY ALTITUDE                                    | PERF MARGINS | PERFORMANCE MARGINS                     |
| DL            | DESCENDING LEFT                                     | P/L          | PAYLOAD                                 |
| DOLILU        | DAY OF LAUNCH I-LOAD UPDATE                         | PLNG         | PLANNING SHIFT                          |
| DR            | DESCENDING RIGHT                                    | PLS          | PLANNED LANDING SITE                    |
|               |   | P/S          | PAYLOAD SPECIALIST                      |
| EDW           | EDWARDS AFB   | PTA          | PRESS TO ABORT ONCE AROUND              |
| EMU           | ENVIRONMENTAL MOBILITY UNIT                         | PTM          | PRESS TO MECO                           |
| ET            | EXTERNAL TANK                                       |              |   |
| EVA           | EXTRA VEHICULAR ACTIVITY                            | R            | SS ROOKIE NUMBER                        |
|               |   | RECON        | RECONSTRUCTED                           |
| F             | SS FEMALE NUMBER                                    | RMS          | REMOTE MANIPULATOR SYSTEM               |
| FD            | FLIGHT DIRECTOR                                     | RPT          | RUPTURE OF ET IN THOUSANDS OF FEET      |
| FDRD          | FLIGHT DEFINITION & REQUIREMENTS DOCUMENT           | RSRM         | REDESIGNED SOLID ROCKET MOTOR           |
| FPR           | FLIGHT PLANNING RESERVE                             | RTLS         | RETURN TO LAUNCH SITE                   |
| FRD           | FLIGHT REQUIREMENTS DOCUMENT                        |              |   |
|               |   | SEQ          | SEQUENTIAL                              |
| GMTLO         | GREENWICH MEAN TIME OF LIFTOFF                      | SLS          | SECONDARY LANDING SITE                  |
|               |   | SODB         | SHUTTLE OPERATIONAL DATA BOOK           |
| HA/HP         | APOGEE AND PERIGEE IN NAUTICAL MILES                | SS           | SPACE SHUTTLE OR SUN SHIELD             |
| HDOT          | TOUCHDOWN ALTITUDE RATE                             | SSME         | SPACE SHUTTLE MAIN ENGINE               |
|               |   | S/T          | SHUTTLE TOTAL FLIGHT TIME               |
| KEAS          | KNOTS EQUIVALENT AIRSPEED                           | TAL          | TRANSOCEANIC ABORT LANDING              |
| KGS           | KNOTS GROUND SPEED                                  | TD NORM 195  | NORMALIZED TOUCHDOWN RANGE AT 195 KEAS  |
| KSC W/D       | KSC WORKDAY   | TDDP         | TRAJECTORY DESIGN DATA PACKAGE          |
|               |   | TDEL         | DIFFERENCE IN REFERENCE TIME            |
| LD/O1         | LEAD/ORBIT 1 SHIFT                                  | TK           | FOR SSME THROTTLE ADJUSTMENT            |
| LDA           | LAUNCH DANGER AREA                                  | T/V          | TANK                                    |
|               |   |              | TUMBLE VALVE                            |
| M             | SS MALE NUMBER                                      | V            | SS VETERAN NUMBER                       |
| M 3 EOM       | MACH 3 END OF MISSION                               | VAB          | VEHICLE ASSEMBLY BUILDING               |
| MECO          | MAIN ENGINE CUT OFF                                 | VEL          | VELOCITY                                |
| MET           | MISSION ELAPSED TIME                                | VI           | INERTIAL VELOCITY                       |
| MLGTD         | MAIN LANDING GEAR TOUCHDOWN                         |              |   |
| MLP           | MOBILE LAUNCH PLATFORM                              | W/D          | WORKDAY                                 |
| MMT           | MISSION MANAGEMENT TEAM                             | WX           | WEATHER                                 |
| MMU           | MANNED MANEUVERING UNIT/                            |              |   |
| MOD           | MISSION OPERATIONS DIRECTOR                         | X CG         | X CENTER OF GRAVITY                     |
|               | MISSION OPERATIONS DIRECTORATE                      | XRANGE       | CROSSRANGE                              |
|               |   |              |   |
|               |   | ZZA          | ZARAGOZA (TAL SITE)                     |



# ABOUT THIS DOCUMENT

## CONVERSION FROM INFORMAL DOCUMENT

Robert D. “Bob” Legler/DA8/USA was the originator of this book as an informal Mission Operations Document to provide a “handy reference guide” for “as flown” mission data, often used by JSC Flight Controllers and Mission Planners.

Mr. Legler authored the informal book from flight STS-1 through flight STS-115. After Legler’s death in 2007, Floyd V. Bennett/DA8/USA/GHG took over the authorship for STS-116 and all missions to follow. In addition, a “Brief Mission Summary” statement for all ISS assembly missions and pertinent mission related photos to each summary file were incorporated.

This formal NASA document is a conversion of the informal version to provide an official historical record of pertinent Space Shuttle Missions Operational Data.

## DOCUMENT FORMAT

The “as flown” operational mission data is presented in a summary table format of twelve columns. For early flights the book contains one page of data per flight. For later flights, as on-orbit activities became more and more complex, additional pages per flight were added, primarily for growth in the 12th column, “Mission Highlights”.

In addition a summary table of weight data for each shuttle element and payloads for each mission is provided in Appendix A.

In Appendix B the authors acknowledge individuals for contributions to the preparation of this document and provides the data sources and Points of Contact (POCs) used in compiling flight and weight data.

Appendix C provides an historical record of JSC Flight Controllers originally compiled by Bob Legler, “History Flight”. Since his death the listing has been maintained by the JSC Flight Directors Office.

And lastly, information about the authors is provided in the back of the book including an “In Memoriam” for Bob Legler.

## MISSION SUMMARIES DATA DEFINITIONS

This section contains definitions of the data provided in the Mission Summaries by column number. Several entries have been assigned sequential numbers for reference purposes (e.g., # of rendezvous, # of night launches, # EVAs, etc.).

### **Column 1:**

FLIGHT NUMBERS - The flight numbers include the official STS flight designator, followed by: the original flight designator (as applicable), the sequential flight number, the KSC launch sequential number, the OFT flight number (as applicable), the ISS flight number (as applicable), the launch pad sequential number, and MLP used.

### **Column 2:**

ORBITER - Provides Orbiter designation, number of flights flown, & OMS PODs #'s.

### **Column 3:**

FLIGHT CREW - Flight Crew members & titles are listed for each flight. Space shuttle flight (SS) number designators are listed for each crew member as follows:

P = sequential number of person flown on SS; R = SS rookie number; V = SS veteran number (second flight on SS); M = SS male number; F = SS female number. No attempt is made to determine which seat arrives first in orbit on the same flight. Example: P17/R2/V1/M2 - person 17, rookie 2, veteran 1, male 2. Once assigned a number, the crew member retains those R, V, & M or F numbers. Only the P number would change on subsequent flights.

EVAs - Relates to SS EVAs. Includes type of EVA, dates/times of EVAs, EVA crew member names, and sequential number of SS EVAs and EVA times.

FLIGHT DIRECTORS - The Flight Directors and Mission Operations Director are listed for each flight.

CAPCOMS - CAPCOMS are listed for missions STS-116 and all to follow.

## ABOUT THIS DOCUMENT

### Column 4:

LAUNCH/LIFTOFF/ASCENT DATA - Includes Pad Number, Liftoff Times [planned (P) and actual (A) in Eastern Time Zone and Greenwich Mean Time (GMT) liftoff time], Date of Launch followed by a number indicating how many SS flights have been launched on that month to date, Day-of-Week Launch followed by a number indicating how many SS flights were launched on the day of the week, Window Duration and Closure Rationale, Planned Landing Sites including those selected on Day of Launch, Ascent Events, and Abort Calls. In the later flights, there are two sets of data in the Ascent Events Column. The left set is planned METs and Velocities, and the right set is the actual METs and Velocities for the specified events.

### Column 5:

LANDING DATA - Includes Landing Site/Runway followed by a Sequential Number indicating the Number of Concrete/Lakebed landings at EDW or a Sequential Number for Landings at NOR and KSC. Landing time is in local time for the landing site. The Landing Day of Week is followed by a Number indicating how many landings have been made on that day of the week. The Number after the Landing Date is the Sequential Number of Landings during that month, i.e., 4/2/92 (7), STS-45 is the seventh landing in April. Each Orbit Direction for Landing is followed by a Sequential Number. The Winds are designated in knots of head, tail and left and right crosswinds. The first listing was obtained from the MOD Descent Postflight Summary and is basically the Winds observed on a display at the touchdown time. The second listing is the “Official” Winds, which are the Two Minute Average Winds spanning the MLG Touchdown Time. The Flight Durations are determined from the time of liftoff to MLG Touchdown, specified in days, hours, minutes, and seconds.  
S/T - Shuttle Total Flight Time, i.e., Accumulated Total. This is followed by an Orbiter Designator and the Accumulated Flight Time for that Orbiter.

### Column 6:

SSME DATA - Includes Nominal, Abort, and Emergency Throttles, Predicted and Actual Throttle Profile, and Engine Serial Numbers followed by the Number of Flights on that engine. For a lack of space elsewhere, the Mach 3 End-of-Mission Weights and X CG and Landing Weight and X CG have been added in this column.

### Column 7:

SRB/SRM/RSRM - Includes the “Build Item” Number followed by SRM/RSRM Type or Number.

ET DATA - Includes ET Numbers, ET Rupture and Breakup Altitudes and Times in MET, and Tumble Valve Use. These times and altitudes were not available for flights after STS-46. However, the time, latitude, and longitude of ET Impact are included for all missions.

### Column 8 :

ORBIT INCLINATION - This is the Inclination after OMS-2 and is followed by a Sequential Number indicating how many flights were flown at that inclination. Inclinations between 28.45 and 28.55 have been considered the same for the purposes of assigning Sequential Numbers.

### Column 9:

ORBIT HA/HP - Insertions were Standard Insertions unless specifically stating “Direct Insertion”. Generally, Altitudes for Post OMS-2 are given, as well as Payload Deploy Altitudes and De-orbit Altitude.

### Column 10:

FLIGHT SOFTWARE DESIGNATORS - OI (Operational Increment) numbers are followed by a Sequential Flight Number for that OI.

## ABOUT THIS DOCUMENT

### **Column 11:**

**PAYLOAD DATA** - Includes Cargo, Chargeable, Deployed, Non-Deployed, and Middeck Weights as documented in the SODB for flights STS-1 through STS-57. Effective with STS-51, the SODB data is no longer updated as flown. Therefore, the data has been obtained from the Day-of-Launch (DOL) Trajectory Design Data Package (TDDP). The following Shuttle Accumulated Weights are provided: (1) Total Payload Deployed Weights left in orbit, (2) Total Non-Deployed Payload Weights (does not include Ancillary Equipment such as ASE, cabling, etc.), and (3) Total Cargo Weights which include all Ancillary Equipment. Weights for seven DOD flights are not included. Performance Margins: Four numbers are provided - (1) Flight Planning Reserve (FPR); (2) Fuel Bias; (3) Final TDDP is margin above FPR, and Fuel Bias using mean wind and atmosphere for launch month, no unplanned drainback and final selected I-load; and (4) Recon is margin above MET wind and atmosphere, any unplanned drainback, final estimated MPS loads (a.k.a., "Reconstructed" Systems Performance). It should be noted that STS-27 Delta Margin was -295 lbs for drainback, -365 lbs for wind/atmosphere. STS-31 Delta Margin was -753 lbs for drainback, +461 lbs for wind/atmosphere. STS-41 was -358 lbs for drainback, -488 lbs for wind/atmosphere. Payloads are identified as being Primary, Payload Bay (PLB), and/or Middeck Payloads. Payload Column also contains the number of cryo Tank sets and whether a RMS was flown followed by a Sequential Number and serial number of the RMS.

### **Column 12:**

#### **MISSION HIGHLIGHTS/MISCELLANEOUS DATA COLUMN** -

Includes the Number of KSC Workdays in OPF, at VAB, at Pad, and Total Workdays. Launch Postponements may not contain early postponements. Postponements are defined as launch delays which occurred prior to call-to-stations for OMI S0007 Shuttle Countdown. Scrubs are launch date changes after the start of Shuttle countdown (countdown was terminated or recycled to a later launch date). Launch Delays are delays which occur only on the day-of-launch. Other data included are TAL Weather Data, Night Launch and Night Landing Sequential Numbers, Flight Duration Changes, Landing Site Changes, Firsts, Events, and Significant Anomalies as judged by the compiler (not all Anomalies are included). Use of Alternate and DOLILU I-loads are included with a Sequential Number for Uplinks. STS-27 was the first flight with the capability to uplink Alternate I-loads for use and STS-48 was the first flight with DOLILU capability. Rendezvous operations are identified including the Target and Sequential Number of each Space Shuttle Rendezvous. Also, a Brief Mission Summary has been added for the first ISS Assembly Mission, STS-88/2A, and all missions to follow.







## 2. SPACE SHUTTLE MISSIONS SUMMARY SECTION

Page 2-0





| FLT   | ORBITER  | CREW<br>(2)   | LAUNCH SITE,<br>LIFTOFF TIME,   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-ABORT<br>EMERG  | SRB<br>RSRM  | ORBIT   |   | FSW   | PAYLOAD<br>WEIGHTS,      | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,                         |
|---|--|---|---|---|--|--|---|---|---|--------------------------|--|
| NO.   |  | TITLE, NAMES<br>& EVA'S   | LANDING SITES,<br>ABORT TIMES   | LANDING TIMES<br>FLT DURATION,<br>WINDS   | THROTTLE<br>PROFILE<br>ENG. S.N.   | AND<br>ET  | INC   | HA/HP   |   | PAYLOADS/<br>EXPERIMENTS | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
| STS-1<br>SEQ<br>FLT #1<br>KSC 1<br>OFT-1<br>PAD<br>39A-1  | OV-102<br>Flight 1<br>Columbia<br>OMS PODS<br>LVO1 - 1<br>RVO1 - 1<br>FRC2 - 1 | CDR:<br>John W. Young<br>P1/R1/M1<br><br>PLT:<br>Robert L. Crippen<br>P2/R2/M2<br><br>MCC FCR-1 (1)<br><br>FLIGHT DIRECTORS:<br>A/PLG - N. B. Hutchinson<br>ORBIT - C. R. Lewis<br>ENT/ORB - D. R. Puddy<br>MOD - E. F. Kranz | KSC 39A<br>102:12:00:03.9Z<br>7:00:00 AM EST (P)<br>7:00:04 AM EST (A)<br>Sunday 1<br>4/12/81 (1)<br><br>WINDOW DURATION:<br>4.7 hours<br><br>PLS - EDW<br>SLS - NOR<br>NO TAL<br>AOA - EDW<br>NOR<br>CLS - HICKAM<br>KADENA<br>ROTA<br><br>MAX Q = 617<br>M = 1.06<br><br>SRB SEP:<br>2:11.7 MET<br><br>MECO:<br>8:34 MET<br><br>ET SEP:<br>8:52.1 MET | EDW 23, LKBD<br>(EDW 1, LKBD 1)<br><br>10:20:57 AM PST<br>Tuesday 1<br>4/14/81 (1)<br><br>XRANGE: 315 NM<br><br>ORB DIR: DR (1)<br><br>AIM PT: NOMINAL<br><br>MLGTD: 6053 FT<br>104:18:20:57Z<br>VEL: 190 KGS<br>183 KEAS<br>HDOT: -1.5 FPS<br><br>TD NORM 195:<br>4973 FT<br><br>NLGTD: 9152 FT<br>104:18:21:07Z<br>VEL: 156 KGS<br>HDOT: -5.6 FPS<br><br>BRK INIT: 105 KGS<br><br>AVE BRK DECEL:<br>5.9 FPS/S<br><br>WHEELS STOP:<br>104:18:21:36Z<br>15046 FT<br><br>ROLLOUT:<br>8993 FT<br>60 SEC<br><br>WIND:<br>2T, 2R KNOTS<br>OFFICIAL: 1H, 1R<br><br>DENS ALT: 2200 FT<br><br>FLT DURATION:<br>2:06:20:53<br>54:20:53<br><br>DISTANCE:<br>933,757 sm | 00/100<br>(100)<br><br>65%<br><br>1 = 2007 (1)<br>2 = 2006 (1)<br>3 = 2005 (1)<br><br>CASE: STD<br>168-80<br><br>SWT<br>ET-1 | A7/8<br>86-80E<br><br>MTR: STD<br><br>START: -25.6°<br><br>END: -19.9°<br><br>MAX: | 40.3°<br>(1)<br><br>STANDARD INSERTION<br><br>INSERTION ALTITUDE:<br>145 NM<br><br>152/152<br>172/172<br>SM | R16/T9<br><br>CARGO:<br>10823 lbs<br><br>DFI:<br>9290 lbs<br><br>SHUTTLE ACCUMULATED WEIGHTS:<br><br>DEPLOYED:<br>0 lbs<br><br>NON-DEPLOYED:<br>10823 lbs<br><br>CARGO TOTAL:<br>10823 lbs<br><br>PERFORMANCE MARGINS NOT AVAILABLE<br><br>PAYLOADS:<br>IECM/REM<br>DFI<br><br>NO RMS<br><br>2 CRYO TANK SETS | KSC W/D: OPF 531, VAB 33, PAD 104 =668<br><br>LAUNCH POSTPONEMENTS: Yes.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 4/10/81 launch at T-18 minutes because BFS did not track PASS timing. Rescheduled launch for 4/12/81. 2-day slip.<br>- Installed SW patch to correct problem.<br><br>LAUNCH DELAYS: 4 seconds.<br><br>CONTINGENCY LANDING SITE (CLS) WX:<br>- Rota was go. There was no TAL site for STS-1.<br><br>FLIGHT DURATION CHANGES: None.<br><br>FIRSTS:<br>- First orbital flight of reusable Space Shuttle vehicle.<br>- First manned vehicle space flight w/o unmanned test flight.<br><br>SIGNIFICANT ANOMALIES:<br>- SRB ignition overpressure (higher than expected) deformed FRCS oxidizer tank aft Z strut.<br>- OMS POD tile LRSI tiles lost.<br>- WMS problems (degraded air suction).<br>- ET tumble system did not work.<br>- PLBD closure overlap more than expected.<br>- Cabin temperature controller did not maintain selected temperature.<br>- OMS quantity gaging system was sticking during flight.<br>- Both Radar Altimeters lost lock at 75 feet (no valid data after 75 feet).<br>- Difficulty locking doors on two storage lockers due to misalignment.<br><br>CONTINGENCY LANDING SITE:<br>- ROTA was a contingency landing site but not required for one SSME out.<br><br>S-BAND TRACKING SITES:<br>- MIL, PDL, BDA, MAD, IOS, ORR, BUC, GDS, HAW, ACN, GWM, QUI, AGO, TUL (NOR), PTT, VDT.<br><br>RADIATORS DEPLOY #1<br><br>NOTE: ON STS-1 AND STS-2, THE NOMINAL OGS AIM POINT WAS 6500 FEET (5500 FEET WAS THE CL OSF-IN AIM POINT) |                          |  |
|   |  |   |   |   |  |  |   |   |   |                          |  |
|   |  |   |   |   |  |  |   |   |   |                          |  |
| <div>We Have Liftoff!<br/>-- April 12, 1981 --<br/>(S81-30500)</div>  |  |   |   |   |  |  |   |   |   |                          |  |
| <div><div>...On-Orbit...<br/>Left: CDR Young in the cockpit<br/>Right: PLT Crippen prepares dinner on middeck</div><div><br/>...In the MCC...<br/>Gene Kranz/FOD, Chris Kraft/JSC Ctr Dir. &amp; Max Faget/E&amp;D (Father of U.S. Manned Spacecraft Design)</div></div>  |  |   |   |   |  |  |   |   |   |                          |  |
| <div><div>M 3 EOM<br/><br/>WEIGHT: 195943<br/><br/>X CG: 1096.7<br/><br/>LANDING<br/><br/>WEIGHT: 195473<br/><br/>X CG: 1098.1</div><div>ET<br/>BR/UP<br/>223K<br/>47:42<br/>MET<br/><br/>ET<br/>IMPACT<br/>LAT:<br/>30.95°S<br/>LONG:<br/>93.2°E</div><div><br/>... and Touchdown at EAFB!<br/>-- April 14, 1981 --<br/>"That's the world's greatest flying machine"<br/>- CDR John Young! (S81-30746)</div></div> |  |   |   |   |  |  |   |   |   |                          |  |

| FLT NO. | ORBITER                  | CREW (2)   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | CROSSRANGE  | SSME-TL NOM-ABORT EMERG   | SRB RSRM AND ET   | ORBIT  |  | FSW     | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---------|--------------------------|--|---|---|---|---|--|--|---------|---|---|
| STS-2   | OV-102 Flight 2 Columbia | CDR: Joe H. Engle P3/R3/M3<br><br>PLT: Richard H. Truly P4/R4/M4<br><br>MCC FCR-1 (2)  | KSC 39A<br>316:15:09:59.8Z<br>7:20:00 AM EST (P)<br>10:10:00 AM EST (A)<br>Thursday 1<br>11/12/81 (1)<br><br><u>WINDOW DURATION:</u><br>4.7 hours             | EDW 23, LAKEBED (EDW 2, LKBD 2)<br>1:23:12 PM PST<br>Saturday 1<br>11/14/81 (1)<br><br><u>XRANGE:</u> 63 NM<br><br><u>ORB DIR:</u> DR (2)<br><br><u>AIM PT:</u> NOMINAL<br><br>MLGTD: 780 FT<br>318:21:23:12Z<br>VEL: 186 KGS<br>197 KEAS<br>HDOT: -1.0 FPS<br><br><u>TD NORM 195:</u><br>960 FT<br><br>NLGTD: 4429 FT<br>318:21:23:26Z<br>VEL: 137 KGS<br>HDOT: -5.1 FPS | 100/100 (107)<br><br>68%<br><br>1 = 2007 (2)<br>2 = 2006 (2)<br>3 = 2005 (2)      | A9/10<br><br><u>MTR:</u> STD<br><br><u>CASE:</u> STD<br>168-80<br><br>SWT<br>ET-2 | 38.0° (1)<br>63.25°<br><br><u>START:</u> -53.5°<br><br><u>END:</u> -56.2°          | <u>STANDARD INSERTION</u><br><br><u>INSERTION ALTITUDE:</u><br>137 NM<br><br>120/120<br>137/137 NM | R18/T11 | <u>CARGO:</u><br>18778 lbs<br><br><u>CHARGEABLE:</u><br><br><u>SHUTTLE ACCUMULATED WEIGHTS:</u><br>0 lbs<br><u>DEPLOYED:</u><br>29601 lbs<br><u>NON-DEPLOYED:</u><br>29601 lbs<br><u>CARGO TOTAL:</u><br>29601 lbs<br><br><u>PERFORMANCE MARGINS (LBS):</u><br>FPR: 7057<br>FUEL BIAS: 1050<br>FINAL TDDP: 2049<br>RECON: 275<br><br><u>PAYLOADS:</u><br>IECM/REM<br>OSTA-1/PALLET<br>MAPS<br>SMIRR<br>SIR-A<br>FILE<br>OCE<br>DFI<br><br>RMS 1 (S.N. 201)<br>RMS CHECKOUT (UNLOADED OPS)<br><br>2 CRYO TANK SETS | KSC W/D: OPF 99, VAB 18, PAD 70 = 187<br><br><u>LAUNCH POSTPONEMENT:</u><br>- 45-day postponement caused by FRCS N204 spill on tiles resulting in debonding of tiles.<br><br><u>LAUNCH SCRUB:</u><br>- Scrubbed 11/4/81 launch at T-31 seconds because APU's 1 & 3 lube oil outlet pressure high at 100 to 112 PSIA. Flushed APU's 1 and 3 gear boxes and changed clogged filters. Rescheduled launch for 11/12/81. 53 days total slip.<br><br><u>LAUNCH DELAYS:</u><br>- 2H40M delay MDM OF3 failure. Flew in replacement MDM which also failed. Replaced with OV-099 MDM.<br>- 10-minute delay for KSC confidence review of systems status.<br>- Total launch delay: 2H50M<br><br><u>TAL WX:</u> Rota go.<br><br><u>FLIGHT DURATION CHANGE:</u><br>- Shortened flight from 5D4H to 2D6H (priority flight after Fuel Cell 1 failed at 0/04:45 MET).<br><br><u>FIRSTS:</u><br>- First flight of RMS.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Fuel Cell 1 failure at 0/04:45 MET resulting in priority mission. Shortened flight from planned 5D4H to 2D6H.<br>- Icing in WSB 3 inhibited lube oil cooling, resulting in elevated APU gearbox outlet temp.<br>- Excessive gas in drinking water.<br>- TV camera B RMS elbow camera, PLB cameras A,B,C lenses had contamination.<br>- CRT 1 failed due to HV power supply problem.<br>- RH SRB lost one main chute.<br>- RH SRM aft field joint gas leak to primary O-ring with erosion.<br>- LH fwd windows degraded by salt spray.<br><br>RADIATORS DEPLOYED #2 (port stowed last 1/2 of flight)<br><br>NOTE: ON STS-1 AND STS-2, THE NOMINAL OGS AIM POINT WAS 6500 FEET (5500 FEET WAS THE CLOSE-IN AIM POINT). |
|         |                          |    | FLIGHT DIRECTORS:<br>ASC - N. B. Hutchinson<br>PLNG - T. W. Holloway<br>ORBIT - C. R. Lewis<br>ENT - D. R. Puddy<br>ORB - H. M. Draughon<br>MOD - E. F. Kranz | PLS - EDW<br>SLS - NOR<br>TAL - ROTA (Selected)<br><br><u>MAX Q</u> = 640<br>M = 1.09   |  |   |  |  |         |   |   |
|         |                          |    |   |   |   |   |  |  |         |   |   |
|         |                          | S81-39499-- President Ronald Reagan is briefed by Dr. Christopher C. Kraft, Jr., JSC Director, pointing to MOCR screen. The President said, "Dr. Kraft, I was in the calvary, I don't understand all this." Then he talked to crew on orbit. |   |   |   |   |  |  |         |   |   |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER  | CREW (2)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br><br>AND<br>ET  | ORBIT  |  | FSW   | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|---|---|--|---|---|--|--|---|--|--|
| STS-3<br><br>SEQ<br>FLT # 3<br><br>KSC 3<br><br>OFT-3<br><br>PAD<br>39A-3 | OV-102<br>Flight 3<br>Columbia<br><br><br><br>OMS PODS<br>LVO1 - 3<br>RVO1 - 3<br>FRC2 - 3 | CDR:<br>Jack R. Lousma<br>P5/R5/M5<br><br>PLT:<br>C. Gordon Fullerton<br>P6/R6/M6<br><br>MCC FCR-1 (3)<br><br>FLIGHT DIRECTORS:<br>ASC/PLG - T. W. Holloway<br>LD/ORB - N. B. Hutchinson<br>PLNG - J. T. Cox<br>O/E - H. M. Draughon<br>MOD - E. F. Kranz | KSC 39A<br>81:15:59:59.875Z<br>10:00:00 AM EST (P)<br>11:00:00 AM EST (A)<br>Monday 1<br>3/22/82 (1)<br><br>WINDOW<br>DURATION:<br>6.1 hours<br><br>PLS - EDW<br>SLS - NOR<br>TAL - ROTA<br>(Selected)<br><br>MAX Q = 651<br>M = 1.04 | WSMR 1<br>NORTHROP STRIP<br>17 (LAKEBED)<br>9:04:45 AM MST<br>Tuesday 2<br>3/30/82 (1)<br><br>X RANGE: 276 NM<br><br>ORB DIR: AR (1)<br><br>AIM PT: NOM<br><br>MLGTD: 1092 FT<br>89:16:04:44.8Z<br>VEL: 233 KGS<br>220 KEAS<br>HDOT: -5.7 FPS<br><br>TD NORM 195:<br>3342 FT<br><br>NLGTD: 6261 FT<br>89:16:04:59.7Z<br>VEL: 176 KGS<br>HDOT: -8.4 FPS<br><br>BRK INIT: 149 KGS<br><br>AVE BRK DECEL:<br>5 FPS/S<br><br>WHEELS STOP:<br>89:16:06.09Z<br>14824 FT<br><br>ROLLOUT:<br>13737 FT 84 SEC<br><br>WINDS:<br>14H, 2L KNOTS<br>OFFICIAL: 13H, 1L<br><br>DENS ALT: 3700 FT | 100/100<br>(107)<br><br>68%<br><br>1 = 2007 (3)<br>2 = 2006 (3)<br>3 = 2005 (3)<br><br>M 3 EOM<br><br>WEIGHT:<br>207349<br><br>X CG: 1095.4<br><br>LANDING<br><br>WEIGHT:<br>207073<br><br>X CG: 1096.9<br><br>-----<br>FLT<br>DURATION:<br>8:00:04:45<br>192:04:45<br><br>S/T:<br>12:12:38:50<br><br>OV-102:<br>12:12:38:50<br><br>DISTANCE:<br>3,900,000 sm | A11/12<br><br>MTR:<br>STD<br><br>CASE: STD<br>86-80E<br><br>SWT<br>ET-3<br><br>ET RPT<br>235K<br>49:18 MET<br>ET<br>BR/UP<br>210K<br>49:58 MET<br>ET<br>IMPACT<br>LAT:<br>31.2°S<br>LONG:<br>94.4°E | 38.0°<br>(2)<br>64.14°<br><br>START:<br>-33.2°<br><br>END:<br>-26.0°<br><br>MAX:<br>-36.0° | STANDARD<br>INSERTION<br><br>INSERTION<br>ALTITUDE:<br>130 NM<br><br>DEORBIT<br>130 X<br>120 NM<br><br>VELOCITY<br>25659 FPS<br><br>RANGE<br>4144 NM | R18/T11<br><br>CARGO:<br>22710 lbs<br><br>CHARGEABLE:<br><br>RETURNED:<br>24492.8 lbs<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>0 lbs<br>NON-DEPLOYED:<br>52311 lbs<br>CARGO TOTAL:<br>52311 lbs<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 7444<br>FUEL BIAS: 1050<br>FINAL TDDP: 5343<br>RECON: 2278<br><br>PAYLOADS:<br>IECM/REM<br>EEVT<br>HBT-HEFLEX<br>OSS-1 PDP/REM<br>(PLASMA<br>DIAGNOSTIC<br>PACKAGE)<br>DFI<br><br>RMS 2 (S.N. 201)<br><br>LOADED TESTS<br>USING PDP<br><br>WAVE PDP<br>OUTSIDE P/L BAY<br><br>3 CRYO TANK<br>SETS | KSC W/D: OPF 55, VAB 12, PAD 30=97<br><br>LAUNCH POSTPONEMENTS: None.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS:<br>- Launch delayed 1 hour. SSME GN <sub>2</sub> purge heater temp sensor failed in GSE.<br><br>TAL WX: Rota go.<br><br>LANDING SITE CHANGE:<br>- EDW lakebed to WSSH because EDW lakebed was wet.<br><br>FLIGHT DURATION CHANGE:<br>- Flight extended from 7 to 8 days because of sand storm at WSSH.<br><br>FIRSTS:<br>- First flight without white paint on ET. (800 lbs weight savings. STS-1 and STS-2 ET's were painted white.)<br><br>SIGNIFICANT ANOMALIES:<br>- Early shutdown of APU 3 due to WSB3 freezeup causing high lube oil temp.<br>- R ENG hydraulic lockup at 82% at To plus 8 min 12 sec due to early shutdown of APU.<br>- RMS wrist TV camera failed causing IECM OPS to be canceled.<br>- AFT bulkhead latch did not fully latch (top sun for 15 minutes and latches operated normally).<br>- WMS (slinger stopped on day 5).<br>- Missing tiles on FWD upper fuselage and upper body flap.<br>- CCTV camera C failed, camera B zoom failed.<br>- ARPCS GN <sub>2</sub> usage excessive (cold soak induced leak).<br>- S-Band xponder 1 failed in hi and low power modes (downlink).<br>- S-Band xponder 2 failed in low power mode (downlink). (Contaminants in RF control relay.)<br>- S-band Power Amp reduced power output.<br>- VTR tape broke.<br>- Ammonia boiler controllers A&B failed.<br>- Cracked rotor RH outboard MLG brake.<br>- WSMR dust storm caused significant maintenance and cleanup of orbiter (gypsum contamination).<br>- One RH SRB main chute failure 3 seconds after deployment.<br><br>RADIATORS DEPLOYED #3 |  |



**CREW AT WORK ON ORBIT**  
ABOVE: s03-22-123 --- CDR Lousma  
BELOW: s03-23-178 --- PLT Fullerton



**MGR's AT WORK IN MCC--** Lt to Rt: Glynn Lunney /Mgr P/L Integ, Chris Kraft /JSC Ctr Director, a person unknown, & Aaron Cohen /Mgr Orbiter Project discuss a flight issue.







**S82-28746 : First flight with ET white paint deleted for 800 lb weight savings.**

**NO MORE ET PAINT**








| FLT NO.  | ORBITER  | CREW (2)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.  | SRB RSRM<br><br>AND ET   | ORBIT  |  | FSW  | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|--|--|---|--|--|--|--|--|--|---|
| STS-4<br><br>SEQ<br>FLT # 4<br><br>KSC 4<br><br>OFT-4<br><br>PAD<br>39A-4                                  | OV-102<br>Flight 4<br>Columbia<br><br><br><br><br><br><br><br><br><br>OMS PODS<br>LVO1 - 4<br>RVO1 - 4<br>FRC2 - 4 | CDR:<br>Thomas K. Mattingly<br>P7/R7/M7<br><br>PLT:<br>Henry W. Hartsfield<br>P8/R8/M8<br><br>MCC FCR-1 (4)<br><br>FLIGHT DIRECTORS:<br>Asc - T. W. Holloway<br>Ld/Orb - C. R. Lewis<br>Plng - J. T. Cox<br>Plng - J. H. Greene<br>Orb/Ent - H. M. Draughon<br>MOD - E. F. Kranz | KSC 39A<br>178:14:59:59.8Z<br>11:00:00 AM EDT (P)<br>11:00:00 AM EDT(A)<br>Sunday 2<br>6/27/82 (1)<br><br>WINDOW DURATION:<br>4.4 hours<br><br>PLS - EDW<br>SLS - KSC<br>CLS - NOR<br>AOA - EDW<br>AOA WX - NOR<br>TAL - DAKAR<br>TAL WX - ROTA (Selected)<br><br>MAX Q = 721<br>M = 1.74<br><br>SRB SEP:<br>2:10 MET<br><br>MECO:<br>8:32.7 MET<br><br>ET SEP:<br>8:50:4 MET<br><br>OMS-1:<br>10:32.6 MET<br>88 Seconds<br><br>OMS-2:<br>37:40.6 MET<br>104 Seconds | EDW 22, CONC (EDW 3, CONC 1)<br><br>9:09:40 AM PDT<br>Sunday 1<br>7/4/82 (1)<br><br>XRANGE: 581 NM<br>ORB DIR: DL (1)<br><br>AIM PT: NOM<br><br>MLGTD: 948 FT<br>185:16:09:39.9Z<br>VEL: 196 KGS<br>204 KEAS<br>HDOT: -1.1 FPS<br><br>TD NORM 195: 1758 FT<br><br>NLGTD: 4988 FT<br>185:16:09:53Z<br>VEL: 158 KGS<br>HDOT: -3.7 FPS<br><br>BRK INIT: 133 KGS<br><br>AVE BRK DECEL: 6.4 FPS/S<br><br>WHEELS STOP: 185:16:10:44Z<br>10826 FT<br><br>ROLLOUT: 9878 FT<br>64 SEC<br><br>WIND: 15H, 7L KNOTS<br>OFFICIAL: 12H, 1R<br><br>DENS ALT: 3563 FT<br><br>FLT DURATION: 7:01:09:40<br>169:09:40<br><br>S/T: 19:13:48:30<br><br>OV-102: 19:13:48:30<br><br>DISTANCE: 2,900,000 sm | 100/100 (107)<br><br>100/65/100/65<br><br>1 = 2007 (4)<br>2 = 2006 (4)<br>3 = 2005 (4)<br><br>M 3 EOM<br><br>WEIGHT: 209141<br><br>X CG: 1092.9<br><br>LANDING<br><br>WEIGHT: 208947<br><br>X CG: 1094.4 | A13/14<br><br>MTR: STD<br><br>CASE: STD 86-80E<br><br>SWT<br>ET-4<br><br>ET RPT 228K<br>47:19 MET<br><br>ET<br>BR/UP 204K<br>47:56 MET<br><br>ET<br>IMPACT<br>LAT: 28.4°S<br>LONG: 83.07°E | 28.529° (1)<br><br>START: -1.2°<br><br>END: +20.5° | STANDARD INSERTION<br><br>INSERTION ALTITUDE:<br><br>POST OMS-2 139.2 X 131.05 NM<br><br>DEORBIT 175 X 160 NM<br><br>VELOCITY 25800 FPS<br><br>RANGE 3810 NM | R18/T11<br>CARGO: 24492 lbs<br><br>PAYLOAD CHARGEABLE: 11644 lbs<br><br>PRIMARY P/L: 9800 lbs<br><br>ANCILLARY: 1844 lbs<br><br>RETURNED: 24492.8 lbs<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 0 lbs<br>NON-DEPLOYED: 63955 lbs<br>CARGO TOTAL: 76803 lbs<br><br>PERFORMANCE MARGINS (LBS): FPR: 6210<br>FUEL BIAS: 1474<br>FINAL TDDP: 4038<br>RECON: 1195<br><br>PRIMARY: DOD 82-1<br>ICEM/REM<br><br>ANCILLARY: ACIP<br>GAS (UTAH STATE)<br>STUDENT EXP'S: (1) CHOLESTEROL<br>(2) CHROMIUM LEVEL (Deficiency)<br>MLR<br>CFES (MID-DECK)<br>TGE<br>NOSL<br><br>3 CRYO TANK SETS<br><br>RMS 3 (S.N. 201)<br><br>WAVED IECM OUTSIDE P/L BAY | KSC W/D: OPF 41, VAB 7, PAD 29=77<br><br>LAUNCH POSTPONEMENTS: None.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX: Dakar no go - crosswinds.<br><br>FLIGHT DURATION CHANGE: None.<br><br>FIRSTS:<br>- First flight with student experiments.<br><br>SIGNIFICANT ANOMALIES:<br>- Hail stones on tile at L-1 day (repaired tiles).<br>- Water found in thrusters F2R & F4R.<br>- During prelaunch rain storms, approximately 500 lbs water absorbed by tiles requiring bottom-to-sun for many hours to dry-out water (to prevent ice damage to tile).<br>- GAS activation problems - successful workaround.<br>- VTR would not rewind.<br>- AFT bulkhead actuator on port PLBD stalled during latch closure.<br>- AFT STBD, FWD port, and FWD bulkhead floodlights failed.<br>- Thermal conditioning required to close PLBD's.<br>- WMS slinger slowed down.<br>- Mid-deck TV camera operation erratic.<br>- DFI PCM recorder data lost.<br>- Both SRB's lost (impacted water at extremely high velocity).<br>- Right and left inboard brakes damaged.<br>IFM - GAS EXPERIMENTS RECOVERY<br>RADIATORS DEPLOYED #4 |   |
|                            |  |  | S82-33394: Columbia stopover at Ellington during return to KSC.  |   |  |  |  |  |  |  |   |
|                          |  |  |   |   |  |  |  |  |  |  |   |
| S82-31207 -- CDR Mattingly (right) & PLT Hartsfield ready to fly fourth & final Orbital Flight Test (OFT). |  |  |   |   |  |  |  |  |  |  |   |





## Page 2-5 - STS-5

[illegible]




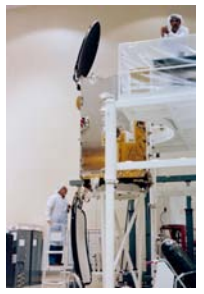
| FLT NO.   | ORBITER  | CREW (4)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br><br>AND<br>ET  | ORBIT   |   | FSW     | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--|---|--|--|---|---|---|---|---------|---|--|
| STS-6<br><br>SEQ<br>FLT # 6<br><br>KSC 6<br><br>PAD<br>39A-6  | OV-099<br>Flight 1<br>Challenger<br><br><br><br><br><br>OMS PODS<br>LPO1 - 1<br>RPO1 - 1<br>FRC9 - 1 | <u>CDR:</u><br>Paul J. Weitz<br>P13/R13/M13<br><br><u>PLT:</u><br>Karol J. Bobko<br>P14/R14/M14<br><br><u>M/S:</u><br>F. Story Musgrave<br>P15/R15/M15<br><br><u>M/S:</u><br>Donald H. Peterson<br>P16/R16/M16<br><br><u>EMU/TETHERED EVA:</u><br>EVA: 4/7/83<br>EV1-Musgrave<br>EV2-Peterson<br>EVA1=3:54/4:42<br>Space Shuttle EVA #1<br><br>EVA HARDWARE<br>CHECKOUT<br><br>MCC FCR-2 (2)<br><u>FLIGHT DIRECTORS:</u><br>Ascent - J. H. Greene<br>Orb/Ent - G. E. Coen<br>Ld/Orb - H. M. Draughon<br>Planning - B. R. Stone<br>MOD - E. F. Kranz | KSC 39A<br>94:18:30:00.016Z<br>1:30:00 PM EST (P)<br>1:30:00 PM EST (A)<br>Monday 2<br>4/4/83 (2)<br><br><u>WINDOW DURATION:</u><br>17 Minutes<br>(TAL Lighting)<br><br>TAL - DAKAR<br>NO TAL WX<br>AOA - EDW<br>AOA WX - NOR<br>EOM - EDW<br><br><u>MAX Q</u> = 688<br>M = 1.47<br><br><u>SRB SEP:</u><br>2:09.4 MET<br><br><u>MECO:</u><br>8:19.4 MET<br><br><u>ET SEP:</u><br>8:37.55 MET<br><br><u>OMS-1:</u><br>10:19.6 MET<br>139.6 Seconds<br><br><u>OMS-2:</u><br>43:37.6 MET<br>119.1 Seconds | EDW 22 CONC<br>(EDW 5, CONC 3)<br><br>10:53:42 AM PST<br>Saturday 2<br>4/9/83 (2)<br><br><u>XRANGE:</u> 378 NM<br><br><u>ORB DIR:</u> AL (1)<br><br><u>AIM PT:</u> CLOSE IN<br><br><u>MLGTD:</u> 2026 FT<br>99:18:53:42Z<br>VEL: 180 KGS<br>190 KEAS<br>HDOT: -1.5 FPS<br><br><u>TD NORM 195:</u><br>1576 FT<br><br><u>NLGTD:</u> 4970 FT<br>99:18:53:54Z<br>VEL: 146 KGS<br>HDOT: -3.9 FPS<br><br><u>BRK INIT:</u> 136 KGS<br><br><u>AVE BRK DECEL:</u><br>7.3 FPS/S<br><br><u>WHEELS STOP:</u><br>99:18:54:31Z<br>9270 FT<br><br><u>ROLLOUT:</u><br>7180FT<br>49 SEC<br><br><u>WIND:</u><br>21H, 5L KNOTS<br>OFFICIAL: 12H, 3L<br><br><u>DENS ALT:</u> 3177 FT<br><br><u>FLT DURATION:</u><br>5:00:23:42<br>120:23:42<br><br><u>S/T:</u> 29:16:26:38<br><br><u>OV-099:</u><br>5:00:23:42<br><br><u>DISTANCE:</u><br>1,820,000 sm | 104/104<br>(109)<br><br>100/104/81/<br>104/65<br><br>1 = 2017 (1)<br>2 = 2015 (1)<br>3 = 2012 (1)<br>CENTER<br>WAS 2011 | A17/18<br><br><u>MTR:</u> STD<br><br><u>CASE:</u> LWC<br>86-80<br>231-81<br><br>LWT-1<br>ET-8 | 28.48°<br>(3)<br>89.7°<br><br><u>START:</u><br>-21.6°<br><br><u>END:</u><br>-18.8°<br><br><u>MAX:</u><br>-21.9° | <u>STANDARD<br/>INSERTION</u><br><br><u>INSERTION<br/>ALTITUDE:</u><br><br><u>POST OMS-2</u><br>155.45 X 154.48<br>NM | R19/T12 | <u>CARGO:</u><br>46971 lbs<br><br><u>CHARGEABLE:</u><br>46662 lbs<br><br><u>DEPLOYED:</u><br>37546 lbs<br><br><u>NON-DEPLOYED:</u><br>6853 lbs<br><br><u>ANCILLARY P/L:</u><br>2263 lbs<br><br><u>RETURNED:</u><br>9462 lbs<br><br><u>SHUTTLE<br/>ACCUMULATED<br/>WEIGHTS:</u><br><u>DEPLOYED:</u><br>52131 lbs<br><u>NON-DEPLOYED:</u><br>79316 lbs<br><u>CARGO TOTAL:</u><br>155854 lbs<br><br><u>PERFORMANCE<br/>MARGINS (LBS):</u><br>FPR: 5720<br>FUEL BIAS: 1298<br>FINAL TDDP: 4755<br>RECON: 2463<br><br><u>PRIMARY:</u><br>TDRS-A/IUS-2<br><br><u>ANCILLARY:</u><br>MLR<br>CFES (MIDDECK)<br>NOSL<br>GAS (3) IN BAYS<br>3 & 4:<br>- JAPANESE<br>SNOWFLAKE<br><br>3 CRYO TANK<br>SETS<br><br>NO RMS | <u>KSC W/D:</u> OPF 123, VAB 6, PAD 115=244<br><br><u>LAUNCH POSTPONEMENT:</u><br>- 1/20/83 launch postponed 74 days to 4/4/83 because of H2 leak in aft compartment from engine 2011 (SSME #1) during FRF 1. Post-FRF 2 found crack in MCC of 2011. 2015 and 2012 had cracked ASI fuel lines. Replaced ASI lines in all three engines. 74-day slip for engine analysis and fixes.<br><br><u>LAUNCH SCRUBS:</u> None.<br><br><u>LAUNCH DELAYS:</u> None.<br><br><u>TAL WX:</u> Dakar no go - haze.<br><br><u>FLIGHT DURATION CHANGE:</u> None.<br><br><u>FIRSTS:</u><br>- First flight of OV-099.<br>- First flight with HUD.<br>- First EVA on Shuttle Program.<br>- First use of SRB LWT case.<br>- First use of LWT ET.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- TDRS deploy at MET 10:00:01 (Rev 6). IUS problem resulted in TDRS being left in 22000 x 12000 NM orbit. TDRS was maneuvered into geosync orbit using 1 lb attitude thrusters.<br>- IUS problem with TVC.<br>- TPS damage AFRSI on OMS PODS, slumping tiles on nose cap and aero surfaces.<br>- Humidity separator failed (6 wires shorted).<br>- High flow on O2 and N2 systems.<br>- WCCU A & B failed.<br>- GPC 2 failed.<br>- Teleprinter failed.<br>- WMS slinger failed on day 5.<br>- CRT-3 failed.<br>- Gas path through putty on both SRM nozzle-to-case joints.<br><br><u>IFM</u><br>- Removed and stowed CCTV monitors. |
|   |  |   |  |  |   |   |   |   |         |   |  |
|   |  |   |  |  |   |   |   |   |         |   |  |
| First crew to man Challenger. Seated are CDR Weitz (left) and PLT Bobko. Standing are Peterson/MS (left) and Musgrave/MS. |  |   |  |  |   |   |   |   |         |   |  |
|   |  |   |  |  |   |   |   |   |         |   |  |
| S06-10-417: First Shuttle EVA: Musgrave (left) Peterson (right) in cargo bay.   |  |   |  |  |   |   |   |   |         |   |  |



## Page 2-7 - STS-7




| FLT NO.   | ORBITER                                      | CREW (5)   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE  | SSME-TL NOM-ABORT EMERG   | SRB RSRM AND ET  | ORBIT  |         | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|--|---|---|---|--|--|---------|--|---|---|
|   |  | TITLE, NAMES & EVA'S   | LANDING TIMES   | LANDING TIMES   | THROTTLE PROFILE ENG. S.N.  | INC  | HA/HP  |         |  |   |   |
| STS-7   | OV-099 Flight 2 Challenger                   | CDR: Robert L. Crippen (Flt 2 - STS-1) P17/R2/V1/M2<br><br>PLT: Frederick H. Hauck P18/R17/M17<br><br>M/S 1: John M. Fabian (Rt. Rear Seat) P19/R18/M18<br><br>M/S 2: Sally K. Ride (Center Seat) P20/R19/F1<br><br>M/S 3: Norman E. Thagard (Middeck Seat) P21/R20/M19<br><br>MCC FCR-2 (3) | KSC 39A<br>169:11:33:00.33Z<br>7:33:00 AM EDT (P)<br>7:33:00 AM EDT (A)<br>Saturday 1<br>6/18/83 (2)<br><br>PLS - KSC<br>SLS - EDW<br>TAL - DAKAR<br>CLS - ROTA<br>AOA - EDW<br>AOA WX - KSC<br>EOM - KSC<br><br>MAX Q = 701<br>M = 1.56<br><br>SRB SEP: 2:06.2 MET<br><br>MECO: 8:20.1 MET<br><br>ET SEP: 8:38.2 MET<br><br>OMS-1: 10:20.2 MET<br>139.5 Seconds<br><br>OMS-2: 44:30.2 MET<br>120 Seconds | EDW 15, LAKEBED (EDW 6, LKBD 3)<br><br>6:56:59 AM PDT Friday 1<br>6/24/83 (1)<br><br>XRANGE: 738 NM<br>ORB DIR: DL (3)<br><br>AIM PT: NOM<br><br>MLGTD: 2726 FT<br>175:13:56:59Z<br>VEL: 200 KGS<br>202 KEAS<br>HDOT: -1.1 FPS<br><br>TD NORM 195: 3356 FT<br><br>NLGTD: 6843 FT<br>175:13:57:19Z<br>VEL: 158 KGS<br>HDOT: -5.1 FPS<br><br>BRK INIT: 125 KGS<br><br>AVE BRK DECEL: 3.6 FPS/S<br><br>WHEELS STOP: 175:13:58:14Z<br>13176 FT<br><br>ROLLOUT: 10450 FT<br>75 SEC<br><br>WIND: 9H, 8R KNOTS<br>OFFICIAL: 10H, 3R<br><br>DENS ALT: 3000 FT<br><br>FLT DURATION: 6:02:23:59<br>146:23:59<br><br>S/T: 35:18:50:37<br><br>OV-099: 11:02:47:41<br><br>DISTANCE: 2,220,000 sm | 104/104 (109)<br><br>100/104/75/104 /65<br><br>1 = 2017 (2)<br>2 = 2015 (2)<br>3 = 2012 (2) | A51/52<br><br>MTR: STD<br><br>CASE: LWC<br><br>SWT<br>ET-6 | 28.484° (4)<br><br>START: +17.5°<br><br>END: +41.0°<br>MAX:<br><br>POST OMS-2<br>161 X 159.96 NM<br><br>TELESAT<br>DEPLOY<br>162.21 NM<br><br>PALAPA DEPLOY<br>162.61 NM | R19/T12 | CARGO: 37124 lbs<br><br>CHARGEABLE: 31893 lbs<br><br>ANCILLARY P/L: 3942 lbs<br><br>DEPLOYED: 14949 lbs<br><br>NON-DEPLOYED: 13002 lbs<br><br>RETURNED: 22175 lbs<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 67080 lbs<br>NON-DEPLOYED: 96260 lbs<br>CARGO TOTAL: 192978 lbs<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 5539<br>FUEL BIAS: 1603<br>FINAL TDDP: 2940<br>RECON: 2021<br><br>PRIMARY: TELESAT-F/ PAM-D (ANIK-C) DEPLOYED<br><br>PALAPA-B1/PAM-D DEPLOYED<br><br>SPAS-01 DEPLOYED AND RETRIEVED<br><br>CFES, MLR<br>OSTA-2: (MPE,MEA,MAUS)<br>GAS-G002,G305, G009,G033,G088,G012 AND G345<br><br>ANCILLARY: MLR<br>CFES (MID-DECK)<br>GAS (7) BAYS 2-5<br>STUDENT EXP.<br><br>3 CRYO TK SETS<br><br>RMS 4 (S.N. 201)<br><br>Deployed and retrieved SPAS-01 | KSC W/D: OPF 34, VAB 5, PAD 21=60<br><br>LAUNCH POSTPONEMENTS: None.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX: Dakar go.<br><br>LANDING SITE CHANGE: - KSC to EDW (Poor visibility at KSC).<br><br>FLIGHT DURATION CHANGE: - Extended 1 day from 5 to 6 days plus 2 revs to land at EDW.<br><br>FIRSTS: - First flight with 5 crewmembers.<br>- First US flight with female astronaut.<br>- First payload deployed and retrieved same flight (SPAS-01).<br>- First PROX OPS and reberthing of payload (SPAS-01).<br>- First flight with Ku-band antenna (Ku-band not used).<br>- First planned landing at KSC.<br>- First PROX OPS (with SPAS-01).<br><br>EVENTS: - TELESAT-F deployed on rev 4.<br>- PALAPA-B1 deployed on rev 15.<br><br>SIGNIFICANT ANOMALIES: - Reduced cabin pressure demonstration (10.2 PSIA).<br>- Bus-tie demonstration post-landing fired one set of PYROS for MLG uplock release.<br>- WCCU A, B and C failed.<br>- WCCU C and E wall units failed.<br>- Right braking system damaged.<br>- APU 3 underspeed shutdown on-orbit.<br>- Locker and cabin door misalignment problems.<br>- Right inboard MLG brake damage.<br>- Challenger window replaced after orbital debris impact. |   |
| SEQ FLT # 7   |  |  |   |   |   |  |  |         |  |   |   |
| KSC 7   |  |  |   |   |   |  |  |         |  |   |   |
| PAD 39A-7   | OMS PODS<br>LPO1 - 3<br>RPO1 - 3<br>FRC9 - 3 |  |   |   |   |  |  |         |  |   |   |
| <div></div> <p>In the MCC: At Top: S83-36179 Gene Kranz, MOD Director &amp; Cliff Charesworth/MOD in back. Left Bottom: S83-34267 Ron Epps/FIDO. Rt Bottom: S83-34270 Ed Fendell/INCO (rt) &amp; astronaut Gordon Cooper.</p> |  |  |   |   |   |  |  |         |  |   |   |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER  | CREW (5)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG   | SRB RSRM   | ORBIT   |   | FSW     | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|--|---|---|--|---|--|---|---|---------|---|--|
| STS-8<br>SEQ FLT # 8<br>KSC 8<br>PAD 39A-8  | OV-099<br>Flight 3<br>Challenger<br><br>OMS PODS<br>LPO1 - 2<br>RPO1 - 2<br>FRC9 - 2 | CDR:<br>Richard H. Truly<br>(FLT 2 - STS-2)<br>P22/R4/V2/M4<br><br>PLT:<br>Daniel C. Brandenstein<br>P23/R21/M20<br><br>M/S 1:<br>Guion S. Bluford, Jr.<br>(Center Seat)<br>P24/R22/M21<br><br>M/S 2:<br>Dale A. Gardner<br>(Rt Rear Seat)<br>P25/R23/M22<br><br>M/S 3:<br>William E. Thornton<br>(Middeck)<br>P26/R24/M23<br><br>MCC FCR-2 (4)<br><br>FLIGHT DIRECTORS:<br>Asc/Plng - J. H. Greene<br>Orbit 1 - B. R. Stone<br>Ld/O2 - H. M. Draughon<br>Entry - G. E. Coen<br>MOD - E. F. Kranz | KSC 39A<br>242:06:32:00.009Z<br>2:15:00 AM EDT (P)<br>2:32:00 AM EDT (A)<br>Tuesday 1<br>8/30/83 (1)<br><br>LAUNCH WINDOW:<br>41 Minutes<br><br>(INSAT Dply Rev 18)<br><br>PLS - EDW<br>SLS - KSC<br>TAL - DAKAR<br>NO TAL WX<br>AOA - EDW<br>AOA WX - NOR<br>EOM - EDW<br><br>MAX Q = 701<br>M = 1.53<br><br>SRB SEP:<br>2:04.34 MET<br><br>MECO:<br>8:41.62 MET<br><br>ET SEP:<br>8:59.66 MET<br><br>OMS-1:<br>10:41.7 MET<br>138.8 Seconds<br><br>OMS-2:<br>44:51.7 MET<br>116.5 Seconds | EDW 22, CONC<br>(EDW 7, CONC 4)<br>248:07:40:43Z<br>12:40:43 AM PDT<br>Monday 1<br>9/5/83 (1)<br><br>XRRANGE: 519 NM<br><br>ORB DIR: DL (4)<br><br>AIM PT: NOM<br><br>MLGTD: 2793 FT<br>248:07:40:43Z<br>VEL: 196 KGS<br>195 KEAS<br>HDOT: -1.2 FPS<br><br>TD NORM 195:<br>2793 FT<br><br>NLGTD: 5515 FT<br>248:07:40:50Z<br>VEL: 177 KGS<br>HDOT: -4.3 FPS<br><br>BRK INIT: 154 KGS<br><br>AVE BRK DECEL:<br>6.9 FPS/S<br><br>WHEELS STOP:<br>248:07:41:33Z<br>12164 FT<br><br>ROLLOUT:<br>9371 FT<br>50 SEC<br><br>WIND:<br>7H, 0X KNOTS<br>OFFICIAL: 5H, 2L<br><br>DENS ALT: 3600 FT<br><br>FLT DURATION:<br>6:01:08:43<br>145:08:43<br><br>S/T: 41:19:59:20<br><br>OV-099:<br>17:03:56:24<br><br>DISTANCE:<br>2,220,000 sm | 100/104<br>(104)<br><br>100/69/<br>100/65<br><br>1 = 2017 (3)<br>2 = 2015 (3)<br>3 = 2012 (3) | A53/54<br><br>MTR: HPM<br><br>CASE: STD<br><br>LWT-2<br>ET-9 | 28.488<br>(5)<br><br>START:<br>-36.2°<br><br>END:<br>+29.4°<br><br>MAX:<br>+37.0° | STANDARD<br>INSERTION<br><br>INSERTION<br>ALTITUDE:<br><br>POST OMS-2<br>161.07 X<br>160.14 NM<br><br>INSAT DEPLOY<br>159.18 NM | R19/T12 | CARGO:<br>30076 lbs<br><br>PAYLOAD<br>CHARGEABLE:<br>25790 lbs<br><br>DEPLOYED:<br>7445 lbs<br><br>NON-DEPLOYED:<br>13179 lbs<br><br>ANCILLARY:<br>5166 lbs<br><br>RETURNED:<br>22631 lbs<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>74525 lbs<br>NON-DEPLOYED:<br>114605 lbs<br>CARGO TOTAL:<br>223054 lbs<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 6756<br>FUEL BIAS: 780<br>FINAL TDDP: 14863<br>RECON: 15735<br><br>PRIMARY:<br>INSAT-1B/PAM-D<br>(DEPLOYED)<br><br>RMS/PDRS/PFTA<br>DFI PALLET (HEAT<br>PIPE EXPERI-<br>MENT, 2 BOXES<br>OF POSTAL<br>COVERS),<br>RME EXP, EOM<br><br>ANCILLARY:<br>CFES (MIDDECK)<br>GAS (3) BAYS 2-8<br>GAS (4) BAY 5<br>BIO-FEEDBACK<br>ANIMAL<br>ENCLOSURE<br>POSTAL COVERS<br><br>3 CRYO TK SETS<br><br>RMS 5 (S.N. 201)<br><br>USED FOR<br>PFTA OPS | KSC W/D: OPF 26, VAB 4, PAD 25 = 55<br><br>LAUNCH POSTPONEMENTS:<br>- 8/4/83 launch postponed 26 days to 8/30/83 due to removal of TDRS-B from flight (IUS not ready because of problem on STS-6) and time required to checkout TDRS-A on orbit. 26-day slip.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS:<br>- 00H17M delay because of thunderstorms in launch area.<br><br>TAL WX: Dakar go.<br><br>FLIGHT DURATION CHANGE: None.<br><br>FIRSTS:<br>- First Shuttle night launch.<br>- First Shuttle night landing.<br>- First flight to use TDRS for communications (test mode).<br>- First flight to use Ku-band communications.<br>- First flight using SRM HPM.<br>- Bluford became the first African-American to fly in space. He was selected in the first class of Space Shuttle astronauts.<br><br>EVENTS:<br>- Tile survey of Orbiter bottom made using RMS End Effector TV camera.<br>- INSAT-1B deployed on rev 27.<br><br>SIGNIFICANT ANOMALIES:<br>- Completed all 54 DTO's and DSO's planned for flight.<br>- Hydraulic circulation pump 2 failed<br>- GPC-1 failed to sync (recovered OK)<br>- WCCW A wall unit failed, B&E noisy.<br>- CCTV C command problems & out of focus.<br>- CCTV D failed.<br>- TAGS failed.<br>- Rt outboard brake had 3 cracked washers and right inboard had one cracked washer.<br>- Nose gear thruster piston found on runway.<br>- LH and RH SRB nozzles experienced off-nominal erosion.<br>- SRB nozzle erosion was found after recovery.<br>- RH mid window (W5) pitted.<br><br>RADIATORS DEPLOYED #6 (for 2 days) |
|   |  |   |   |  |   |  |   |   |         |   |  |
|   |  | S83-31724 --- Crew: Front row (lt to rt) PLT Brandenstein, CDR Truly, & Bluford/MS (1st African American to fly in space). Back row (lt to rt): Gardner/MS & Thornton/MS.   |   |  |   |  |   |   |         |   |  |
| S83-27154- JSC Center Director Gerry Griffin visits the MOCR. Gene Kranz, Director, Mission Ops is in rear & Flight Director Jay Greene is at right. Others not identified. |  |    |   |  |   |  |   |   |         |   |  |
|   |  | At Right: S83-36307 -- INSAT P/L in prep at KSC   |   | M 3 EOM  |   | ET RPT<br>241K<br>46:30 MET                                  |   | ET BR/UP<br>223K<br>47:01 MET   |         | DEORBIT<br>118 X<br>116 NM<br>VELOCITY<br>25649 FPS<br>RANGE<br>4044 NM   |  |
|   |  | WEIGHT:<br>204141   |   | X CG:<br>1090.4  |   | LANDING  |   | ET IMPACT<br>LAT:<br>28.4°S<br>LONG:<br>81.5°E  |         |   |  |
|   |  | WEIGHT:<br>203945   |   | X CG: 1091.9   |   |  |   |   |         |   |  |



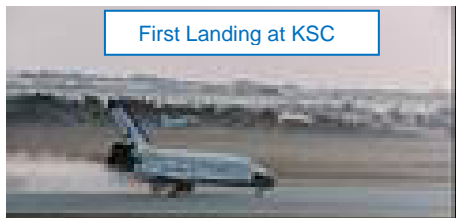



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER                                      | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE,<br>LANDING TIMES<br>FLT DURATION,<br>WINDS | SSME-TL<br>NOM-ABORT<br>EMERG  | SRB<br>RSRM<br>AND<br>ET                            | ORBIT  |                                     | FSW         | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|--|--|--|--|--|---|--|-------------------------------------|-------------|--|--|
| STS-9<br>(STS 41-A)<br>S/L1  | OV-102<br>Flight 6<br>Columbia               | CDR:<br>John W. Young<br>(FLT 2 - STS-1)<br>P27/R1/V3/M1   | KSC 39A<br>332:15:59:59.99Z<br>11:00:00 AM EST (P)<br>11:00:00 AM EST (A)<br>Monday 3<br>11/28/83 (3)                      | EDW 17, LAKEBED<br>(EDW 8, LKBD 4)<br>15:47:24 PM PST<br>Thursday 1<br>12/8/83 (1) | 104/104<br>(107)   | A55/60  | 57.028°<br>(1)   | STANDARD<br>INSERTION               | OI-2<br>(1) | CARGO:<br>33264 lbs<br>PAYLOAD<br>CHARGEABLE:<br>33131 lbs<br>PAYLOAD<br>WEIGHT:<br>33,131 lbs<br>(includes 870 lbs<br>cryo tank)<br>DEPLOYED:<br>0 lbs<br>NON-DEPLOYED:<br>32261 lbs<br>MIDDECK:<br>0 lbs<br>RETURNED:<br>32394 lbs | KSC W/D: OPF 82 (2), VAB 12 (3), PAD 34 (2) = 128 days<br>LAUNCH POSTPONEMENTS:<br>-10/30/83 Launch postponed 29 days to 11/28/83.<br>Rolled back from pad and changed SRB nozzles<br>subsequent to STS-8 excessive nozzle erosion. 29-day<br>slip.<br>LAUNCH SCRUBS: None.<br>LAUNCH DELAYS: None.<br>TAL WX: Zaragoza no go - winds, Koln-Bonn no go -<br>clouds.<br>FLIGHT DURATION CHANGE:<br>- Flight extended 1 day for additional science.<br>- Landing delay 5 revs after GPC 1 and GPC 2 hard<br>failures<br>- Total extension - 1 day + 5 revs.  |
| SEQ<br>FLT # 9   | Spacelab 1<br>LM (1)                         | PLT:<br>Brewster H. Shaw, Jr.<br>P28/R25/M24   | TAL - ZARAGOZA<br>PLS - EDW<br>SLS - NOR<br>TAL - ZARAGOZA<br>IN PLANE TAL -<br>COLOGNE/BONN<br>AOA - NOR<br>AOA WX - NONE | MLGTD: 1649 FT<br>342:23:47:24Z<br>VEL: 200 KGS<br>185 KEAS<br>HDOT: -1.7 FPS      | 100/104/<br>78/104/65  | MTR:<br>HPM   | START:<br>-58.0°   | INSERTION<br>ALTITUDE:              |             | SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>74525 lbs<br>NON-DEPLOYED:<br>147736 lbs<br>CARGO TOTAL:<br>256318 lbs  | FIRSTS:<br>- First flight with 6 crewmen.<br>- First flight of Spacelab after Spacelab only<br>modifications to OV-102.<br>- First flight with non-astronauts (P/S) and first non-<br>Americans.<br>- First use of two shifts of 12 hours (red and blue shifts).<br>- First flight with galley and sleep station.<br>- First flight with 3 substack fuel cells.  |
| KSC 9  | OMS PODS<br>LVO1 - 6<br>RVO1 - 6<br>FRC2 - 6 | M/S 1:<br>Owen K. Garriott<br>P29/R26/M25  | LAUNCH WINDOW:<br>14 Minutes<br>(TAL Lighting)   | TD NORM 195:<br>749 FT   | 1 = 2011 (1)<br>2 = 2018 (1)<br>3 = 2019 (1)                                       | CASE:<br>STD  | END:<br>-79.0°   | POST OMS-2<br>136.75 X<br>132.79 NM |             | PERFORMANCE<br>MARGINS (LBS):<br>FPR: 5404<br>FUEL BIAS: 1084<br>FINAL TDDP: 841<br>RECON: -411  | SIGNIFICANT ANOMALIES:<br>- GPC SV time tag to S/L incremented by 1 day.<br>- Ku-band TWT failed to come on (low temp problem).<br>- Spacelab RAU 21/cooling problem.<br>- Excessive GH <sub>2</sub> in water.<br>- S-band power amp no. 2 failed.<br>- Noises and oscillations reported by crew.<br>- GPC 1 hard failure GPC 2 failure, re-IPL'ed, memory<br>altered, failed again at NLG contact (delayed landing 7-<br>3/4 hours).<br>- IMU 1 failed (power supply failure).<br>- APU 1 and 2 hydrazine leak/fire shutdown after landing<br>(APU 1 and 2 damaged).<br>- Right outboard brakes damaged.<br>- LH OMS pod TPS damage during entry.<br>- Mission extended one day. 8 hours extension to<br>analyze GPC and IMU failures.<br>- LH OMS pod removed for repair after burn-through<br>(missing tile). |
| PAD<br>39A-9   |  | M/S 2:<br>Robert A. R. Parker<br>P30/R27/M26   | MAX Q = 676<br>M = 1.52  | NLGTD: 5897 FT<br>342:23:47:37Z<br>VEL: 146 KGS<br>HDOT: -9.9 FPS                  |  | LWT-4   | MAX:<br>-79.9°   |                                     |             | 5 CRYO TANKS<br>NO RMS   | RADIATORS DEPLOYED #7 (stowed for 34 hours)  |
|    |  | P/S 1:<br>Byron K. Lichtenberg<br>P31/R28/M27  | SRB SEP:<br>2:06.24 MET  | BRK INIT: 126 KGS  |  |   | S09-126-044: First 6 member crew, first<br>non-astronauts (P/S) and first non-<br>Americans, and 3rd Shuttle veteran (CDR<br>Young) re-flight. Crew identified in Col 3. |                                     |             |  |  |
|  |  | P/S 2:<br>Ulf Merbold<br>(Germany)<br>P32/R29/M28  | MECO:<br>8:29.18 MET   | AVE BRK DECEL:<br>6.8 FPS/S  |  |   |  |                                     |             |  |  |
|  |  | MCC FCR-2 (5)  | ET SEP:<br>8:47.32 MET   | WHEELS STOP:<br>342:23:48:17Z<br>10105 FT  |  |   |  |                                     |             |  |  |
|  |  | FLIGHT DIRECTORS:<br>Ascent - J. H. Greene<br>Ld/Orb 1 - C. R. Lewis<br>Orb 2 - J. T. Cox<br>Orb 3 - L. S. Bourgeois<br>Team4/Ent - G. E. Coen | ROLLOUT:<br>8556 FT<br>(10105 FROM<br>THRESHOLD)<br>53 SEC   | WINDS:<br>0 H/T, 0 X KNOTS<br>OFFICIAL: 1T, 0X                                     |  |   |  |                                     |             |  |  |
|  |  |  | OMS-1:<br>10:29.3 MET<br>68.5 Seconds  | DENS ALT: 1900 FT  |  |   |  |                                     |             |  |  |
|  |  |  | OMS-2:<br>40:37.4 MET<br>101.6 Seconds   | FLT DURATION:<br>10:07:47:24<br>247:47:24  |  |   |  |                                     |             |  |  |
|  |  |  |  | S/T: 52:03:46:44   |  |   |  |                                     |             |  |  |
|  |  |  |  | OV-102:<br>34:23:50:20   |  |   |  |                                     |             |  |  |
|  |  |  |  | DISTANCE:<br>3,330,000 sm  |  |   |  |                                     |             |  |  |
|  |  |  |  |  | M 3 EOM  | ET<br>BR/UP<br>199K<br>1:01:00<br>MET               | DEORBIT<br>129 X<br>124 NM   | VELOCITY<br>25696 FPS               |             |  |  |
|  |  |  |  |  | WEIGHT:<br>220288  |   |  |                                     |             |  |  |
|  |  |  |  |  | X CG: 1085.8   |   |  |                                     |             |  |  |
|  |  |  |  |  | LANDING  | ET<br>IMPACT<br>LAT:<br>59.96°S<br>LONG:<br>149.9°E | RANGE<br>4349 NM   |                                     |             |  |  |
|  |  |  |  |  | WEIGHT:<br>220027  |   |  |                                     |             |  |  |
|  |  |  |  |  | X CG: 1087.1   |   |  |                                     |             |  |  |
|  |  |  |  |  |  |   |  |                                     |             |  |  |




s9-32-1112-- - First flight of Spacelab  
after Spacelab only modifications to OV-  
102.

## Page 2-10 - STS-11




| FLT NO.   | ORBITER                    | CREW (5)  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG   | SRB RSRM   | ORBIT  |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|----------------------------|---|--|--|---|--|--|---|--|---|---|
|   |                            | TITLE, NAMES & EVA'S  |  |  | THROTTLE PROFILE ENG. S.N.  | AND ET   | INC  | HA/HP   |  |   |   |
| STS-11 (STS 41-B)   | OV-099 Flight 4 Challenger | CDR: Vance D. Brand (FLT 2 - STS -5) P33/R9/V4/M9<br><br>PLT: Robert L. Gibson P34/R30/M29<br><br>M/S 1: Bruce McCandless II P35/R31/M30<br><br>M/S 2: Ronald E. McNair P36/R32/M31<br><br>M/S 3: Robert L. Stewart P37/R33/M32 | KSC 39A<br>34:12:59:998Z<br>8:00:00 AM EST (P)<br>8:00:00 AM EST (A)<br>Friday 1<br>2/3/84 (1)<br><br>LAUNCH WINDOW: 13 Minutes (PALAPA SUN SHIELD FAIL OPEN)<br><br>PLS - KSC<br>SLS - EDW<br>TAL - DAKAR<br>NO TAL WX<br>CLS - KSC<br>CLS - EDW<br>AOA - EDW<br>AOA WX - NOR<br>EOM - KSC<br><br>MAX Q = 676<br>M = 1.55<br><br>SRB SEP: 2:07.92 MET<br><br>MECO: 8:41.42 MET<br><br>ET SEP: 8:59.57 MET<br><br>OMS-1: 10:41.6 MET<br>150 Seconds<br><br>OMS-2: 45:24.6 MET<br>124.8 Seconds | KSC 15 (KSC 1)<br><br>7:15:55 AM EST Saturday 3<br>2/11/84 (1)<br><br>XRANGE: 524 NM<br><br>ORB DIR: DL (6)<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 1930 FT<br>42:12:15:55Z<br>VEL: 198 KGS<br>196 KEAS<br>HDOT: -2.0 FPS<br><br>TD NORM 195: 2020 FT<br><br>NLGTD: 5789 FT<br>42:12:16:06Z<br>VEL: 159 KGS<br>HDOT: -2.8 FPS<br><br>BRK INIT: 136 KGS<br><br>AVE BRK DECEL: 5.1 FPS/S<br><br>WHEELS STOP: 42:12:17:02<br>12737 FT<br><br>ROLLOUT: 10,815 FEET<br>64 SEC<br><br>WINDS: 5H, 3L KNOTS<br>OFFICIAL: 3T, 2L<br><br>DENS ALT: -200 FT<br><br>FLT DURATION: 7:23:15:55<br>191:15:55<br><br>S/T: 60:03:02:39<br><br>OV-099: 25:03:12:19<br><br>DISTANCE: 2,870,000 sm | 100/104<br>109<br><br>100/73/<br>100/65<br><br>1 = 2109 (1)<br>2 = 2015 (4)<br>3 = 2012 (4)<br><br>M 3 EOM<br><br>WEIGHT: 201529<br><br>X CG: 1087.9<br><br>LANDING<br><br>WEIGHT: 201239<br><br>X CG: 1089.3 | A57/58<br><br>MTR: HPM<br><br>CASE: MWC<br><br>LWT-3<br>ET-10<br>ET<br>RPT 231K<br>46:26<br>MET<br>BR/UP 214K<br>46:51<br>MET<br>ET<br>IMPACT<br>LAT: 28.3°S<br>LONG: 80.6°E | 28.486° (6)<br><br>START: -26.9°<br><br>END: +4.5°<br><br>MAX: | STANDARD INSERTION<br><br>INSERTION ALTITUDE:<br><br>POST OMS-2<br>165.88 X<br>164.61 NM<br><br>PALAPA DEPLOY<br>166.48 NM<br><br>WESTAR DEPLOY<br>153.52 NM<br><br>DEORBIT<br>157 X<br>145 NM<br><br>VELOCITY<br>25752 FPS<br><br>RANGE<br>4137 NM | OI-2 (2)<br><br>CARGO: 33868 lbs<br><br>CHARGEABLE: 28252 LBS<br><br>DEPLOYED: 15073 LBS<br><br>NON-DEPLOYED: 10198 lbs<br><br>ANCILLARY: 2981 lbs<br><br>RETURNED: 18795 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 89598 lbs<br>NON-DEPLOYED: 160915 lbs<br>CARGO TOTAL: 290186 lbs<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 5259<br>FUEL BIAS: 1038<br>FINAL TDDP: 12062<br>RECON: 6961<br><br>PRIMARY: WESTAR-IV/ PAM-D (DEPLOYED)<br><br>PALAPA-B2/ PAM-D (DEPLOYED)<br><br>SPAS 01A<br>MFR PLATFORM<br>MMU (2)<br>MMU/EMU<br>CINEMA 360 (BAY 5)<br>CINEMA 360 (MID-DECK)<br>ACES EXP.<br>IEF EXP.<br>RME EXP.<br><br>ANCILLARY: IRT (DEPLOYED)<br>GAS (5)<br>STUDENT EXP (A.E.M.)<br>SESA+ BEAM (BAY 2)<br>MLR EXP<br>4 CRYO TK SETS<br>RMS 6 (S.N. 201)<br>CANCELED SPAS DEPLOY (RMS PROBLEM) | KSC W/D: OPF 52, VAB 6, PAD 21=80<br><br>LAUNCH POSTPONEMENTS:<br>- 1/24/84 launch was postponed 10 days to 2/3/84 because of ongoing analysis of APU failures on STS-9. 10-day slip.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX: Dakar no go - visibility.<br><br>FLIGHT DURATION CHANGE: None.<br><br>FIRSTS:<br>- First use of Manned Maneuvering Unit (MMU) on EVA.<br>- First untethered EVA crewman on Shuttle flight (320 foot separation from Orbiter).<br>- First use of 10.2 PSIA cabin for EVA prep.<br>- First use of MFR on RMS.<br>- First landing at KSC.<br>- First flight with spare GPC in locker (STS-9 GPC failures reaction).<br><br>EVENTS:<br>- Made Orbiter maneuver to recover foot restraint in PLB.<br>- PALAPA-B deployed on rev 6.<br>- WESTAR-IV deployed on rev 48.<br>- Saw Challenger entry trail from Houston during landing at KSC.<br><br>RENDEZVOUS:<br>- Canceled planned RNDZ when IRT failed.<br><br>SIGNIFICANT ANOMALIES:<br>- RMS wrist joint failure (RMS/SPAS-01 operations canceled). RMS used for PALAPA PKM burn witness plate ops.<br>- Left OMS POD damage from waste water dump nozzle ice (during entry).<br>- IRT failed to inflate properly after deployment (rendezvous canceled).<br>- Both SRB's lost one chute.<br>- WESTAR-IV and PALAPA-B failed to achieve desired orbit due to PAM-D nozzle failure. (Both satellites were retrieved on STS 51-A).<br>- LH SRM forward center field joint gas leak to primary O-ring with erosion.<br>- RH SRM gas leak and erosion to primary O-ring of nozzle-to-case joint.<br>- LH SRB main chute failed to inflate. |   |
|   |                            |   |  |  |   |  |  |   |  |   |   |
|   |                            | MCC FCR-2 (6)<br><br>FLIGHT DIRECTORS:<br>Asc/Ent - G. E. Coen<br>Orbit 1 - B. R. Stone<br>Ld/O2 - H. M. Draughon<br>Plng - L. S. Bourgeois<br>EVA - J. T. Cox  |  |  |   |  |  |   |  |   |   |
|   |                            | In back: MS's/Stewart, McNair & McCandless  |  |  |   |  |  |   |  |   |   |
|   |                            | <br>CDR Brand & PLT Gibson  |  |  |   |  |  |   |  |   |   |
| <div>Feb. 4, 1984: McCandless performed the first untethered excursions wearing the Manned Maneuvering Unit, a rocket propelled backpack. He flew 320 ft from Obiter, further than any previous astronaut.</div>   |                            |   |  |  |   |  |  |   |  |   |   |



## Page 2-11 - STS 41-C

| FLT NO.  | ORBITER                                      | CREW (5)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N.  | SRB RSRM<br><br>AND ET   | ORBIT  |   | FSW  | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|---|---|---|---|--|--|---|--|--|---|
| STS 41-C<br>(STS-13)   | OV-099<br>Flight 5<br>Challenger             | CDR:<br>Robert L. Crippen<br>(Flt 3)<br>(STS-1 & STS-7)<br>P38/R2/V1/M2<br><br>PLT:<br>Francis R. Scobee<br>P39/R34/M33<br><br>M/S:<br>Terry J. Hart<br>P40/R35/M34<br><br>M/S:<br>James D. van Hoften<br>P41/R36/M35<br><br>M/S:<br>George D. Nelson<br>P42/R37/M36<br><br><u>UNTETHERED EVA'S</u><br>(MMU):<br>EV1=Nelson<br>EV2=van Hoften | KSC 39A<br>097:13:57:59.999Z<br>8:58:00 AM EST (P)<br>8:58:00 AM EST (A)<br>Friday 2<br>4/6/84 (3)<br><br><u>LAUNCH WINDOW:</u><br>~3.5 MINUTES<br>(PLANAR WINDOW/ET FOOTPRINT NEAR HAWAII)<br><br>PLS - KSC<br>SLS - EDW<br>TAL - DAKAR<br>TAL WX - ROTA<br>AOA - EDW<br>AOA WX - NOR<br><br><u>MAX Q</u> = 635<br>M = 1.03<br><br><u>SRB SEP:</u><br>2:05.57 MET<br><br><u>MECO:</u><br>8:30.76 MET<br><br><u>ET SEP:</u><br>8:48.9 MET | EDW 17, LAKEBED<br>(EDW 9, LKBD 5)<br><br>5:38:07 AM PST<br>Friday 2<br>4/13/84 (3)<br><br><u>XRANGE:</u><br>381 NM<br><br><u>ORB DIR:</u> DL 7<br><br><u>AIM PT:</u> NOM<br><br>MLGTD: 1912 FT<br>104:13:38:07Z<br>VEL: 220 KGS<br>213 KEAS<br>HDOT: -1.5 FPS<br><br>TD NORM 195:<br>3505 FT<br><br>NLGTD: 7167 FT<br>104:13:38:23Z<br>VEL: 144 KGS<br>HDOT: -4.6 FPS<br><br><u>BRK INIT:</u> 110 KGS<br><br><u>AVE BRK DECEL:</u><br>8.4 FPS/S<br><br><u>WHEELS STOP:</u><br>104:13:38:55Z<br>10628 FT<br><br><u>ROLLOUT:</u><br>8716 FT<br>48 SEC<br><br><u>WINDS:</u><br>2 H, 0 X KNOTS<br>OFFICIAL: 0H, 0X<br><br><u>DENS ALT:</u> 1000 FT<br><br><u>FLT DURATION:</u><br>6:23:40:07<br>167:40:07<br><br><u>S/T:</u> 67:02:42:46<br><br>OV-099:<br>32:02:52:26<br><br><u>DISTANCE:</u><br>2,880,000 sm | 104/104<br>(109)<br><br>100/104/<br>67/104/<br>65<br><br>1 = 2109 (2)<br>2 = 2020 (1)<br>3 = 2012 (5)<br><br><u>M 3 EOM</u><br><br>WEIGHT:<br>197170<br><br>X CG: 1100.0<br><br><u>LANDING</u><br><br>WEIGHT:<br>196976<br><br>X CG: 1101.6 | BI-012<br><br><u>MTR:</u><br>HPM<br><u>CASE:</u><br>MWC<br><br>ET-12<br>LWT-5<br><br><u>ET RPT</u><br>246K<br>1:22:15<br>MET<br><br><u>ET BR/UP</u><br>228K<br>1:22:45<br>MET<br><br><u>ET IMPACT</u><br><u>LAT:</u><br>18.90°S<br><u>LONG:</u><br>149.9°W | 28.45°<br>(7)<br><br><u>START:</u><br>-18.1°<br><br><u>END:</u><br>+12.0°<br><br><u>MAX:</u> | <u>DIRECT INSERTION</u><br><br><u>252 NM</u><br><u>DIRECT INSERTION</u><br><br>251.6 X 115.4 NM<br><br><u>DEORBIT</u><br>268 X<br>265 NM<br><br><u>VELOCITY</u><br>25998 FPS<br><br><u>RANGE</u><br>4090 NM | OI-2<br>(3)<br><br><u>CARGO:</u><br>38266 lbs<br><u>CHARGEABLE:</u><br>33831 lbs<br><u>DEPLOYED:</u><br>21396 lbs<br><u>NON-DEPLOYED:</u><br>12394 lbs<br><u>MIDDECK:</u><br>41 lbs<br><u>RETURNED:</u><br>16870 lbs<br><u>SHUTTLE ACCUMULATED WEIGHTS:</u><br><u>DEPLOYED:</u><br>110994 lbs<br><u>NON-DEPLOYED:</u><br>173350 lbs<br><u>CARGO TOTAL:</u><br>328452 lbs<br><u>PERFORMANCE MARGINS (LBS):</u><br>FPR: 5052<br>FUEL BIAS: 1038<br>FINAL TDDP: 995<br>RECON: -3322<br><u>PRIMARY:</u><br>LONG DURATION EXPOSURE FACILITY (LDEF) (DEPLOYED)<br><br>SMRM/FSS (RETRIEVED, REPAIRED & RELEASED)<br><br>MMU (2)<br>MMU/EMU<br>MFR PLATFORM<br>BAY 10<br>CINEMA 360<br>I-MAX CAMERA<br>RME EXPERIMENT<br><br><u>ANCILLARY:</u><br>STUDENT EXPERIMENTS<br>ACIP<br><br>4 CRYO TANK SETS<br><br>RMS 7 (S.N. 302)<br>Used for LDEF de-ploy, SMRM capture, berth, and de-ploy and water nozzle and OMS pod survey | <u>KSC W/D:</u> OPF 31, VAB 4, PAD 18 = 53<br><br><u>LAUNCH POSTPONEMENT:</u><br>- 4/4/84 launch postponed 2 days to 4/6/84 to upgrade OMS pod TPS (STS 41-B problem during entry). 2-day slip.<br><br><u>LAUNCH SCRUBS:</u> None.<br><br><u>LAUNCH DELAYS:</u> None.<br><br><u>TAL WX:</u> Dakar no go - low clouds.<br><br><u>FLIGHT DURATION &amp; LANDING SITE CHANGES:</u><br>- Extended flight 1 day to replan use of RMS to grapple SMM after TPAD docking failure.<br>- Extended flight 1 rev to land at EDW because of unacceptable weather (overcast) at KSC.<br>- Total extension: 1 day+ 1 rev.<br><br><u>FIRSTS:</u><br>- First flight to use direct insertion.<br>- First rendezvous/satellite repair flight.<br>- First use of TPAD. Nelson used MMU to translate to SMM and attempted to dock using TPAD. TPAD failed to fire because a thermal insulation button prevented it from firing.<br>- First grapple of satellite using RMS.<br>- First direct insertion (no OMS-1 burn).<br><br><u>RENDEZVOUS 1 &amp; 2:</u><br>- To capture, repair, and release SMM.<br><br><u>EVENTS:</u><br>- Nelson held onto solar panel during MMU ops to attempt to slow SMM rotation.<br>- Re-rendezvous with SMM on 5th day & RMS grapple of SMM. Repair and redeploy of SMM on 6th day by van Hoften & Nelson.<br>- RMS used to survey OMS pods and monitor water dumps to ensure no ice chunks on nozzles.<br><br><u>ET TRACKING DTO 331/318 NEAR HAWAII</u><br>- ET Reentry (tumble)-KPTC RADAR poor coverage, MOTIF unusable, CAST GLANCE - LH2 rupture 264-254 Kft debris large DV, "violent rupture."<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- RH SRB main parachute failure.<br>- WCS fan SEP 1 low airflow.<br>- WCS fan SEP 2 failed.<br>- Brake damage similar to STS- 7 on left & right sides.<br>- Ku-band Rndz Radar failed self test & lost lock.<br>- RH SRB one chute failed to inflate.<br>- RH SRM gas leak and erosion to primary O-ring (blowby) nozzle-to-case joint.<br><br>RADIATORS DEPLOYED #8 (for one sleep period) |   |
| SEQ<br>FLT # 11  | OMS PODS<br>LPO3 - 1<br>RPO1 - 5<br>FRC9 - 5 |   |   |   |   |  |  |   |  |  |   |
| PAD<br>39A-11  |  |   |   |   |   |  |  |   |  |  |   |
|    |  |   |   |   |   |  |  |   |  |  |   |
| MCC FCR-2 (7)  |  |   |   |   |   |  |  |   |  |  |   |
| <u>FLIGHT DIRECTORS</u><br>Asc/Ent - G. E. Coen<br>Ld/O 1 - J. H. Greene<br>Orbit 2 - J. T. Cox<br>Planning - B. R. Stone<br>MOD - E. F. Kranz     |  |   |   |   |   |  |  |   |  |  |   |
|    |  |   |   |   |   |  |  |   |  |  |   |
| 41c-07-0262 Crew: PLT Scobee, Nelson/MS, van Hoften/MS, Hart/MS, & CDR Crippen.  |  |   |   |   |   |  |  |   |  |  |   |
| STS41C-36-1618 - LDEF, Deployed by RMS, contained material samples for long term exposure to space by NASA LRC. To be retrieved by STS-32 in 1990. |  |   |   |   |   |  |  |   |  |  |   |
|    |  |   |   |   |   |  |  |   |  |  |   |
| STS41C-38-1852 --- SSM Repair EVA  |  |   |   |   |   |  |  |   |  |  |   |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER                                      | CREW (6)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG  | SRB RSRM AND ET   | ORBIT          |   | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|---|---|--|--|---|----------------|---|---|--|---|
| STS 41-DR (STS-14)   | OV-103<br>Flight 1<br>Discovery              | CDR:<br>Henry W. Hartsfield<br>(Flt 2 - STS-4)<br>P/43/R8/V5/M8<br>PLT:<br>Michael L. Coats<br>P44/R38/M37<br>MS:<br>Steven A. Hawley<br>P45/R39/M38<br>MS:<br>Richard m. Mullane<br>P46/R40/M39<br>MS:<br>Judith A. Resnik<br>P47/R41/F2<br>P/S:<br>Charles Walker<br>(MDAC)<br>P48/R42/M40<br>MCC FCR-1 (5)<br>FLIGHT DIRECTORS<br>Asc/Ent - G. E. Coen<br>Ld/O 1 - B. R. Stone<br>Orbit 2 - J. T. Cox<br>Plng - A. L. Briscoe<br>MOD - F. E. Kranz | KSC 39A<br>243:12:41:50Z<br>8:35:00 AM EDT (P)<br>8:41:50 AM EDT (A)<br>Thursday 3<br>8/30/84 (2) | EDW 17, LAKEBED (EDW 10, LKBD 6)<br>6:37:54 AM PDT<br>Wednesday 1<br>9/5/84 (2)<br>XRANGE: 474 NM<br>ORB DIR: DL 8<br>AIM PT: NOM<br>MLGTD: 2510 FT<br>249:13:37:54Z<br>VEL: 216 KGS<br>200 KEAS<br>HDOT: -1.8 FPS<br>TD NORM 195: 2960 FT<br>NLGTD: 6713 FT<br>249:13:38:08Z<br>VEL: 170 KGS<br>HDOT: -5.6 FPS<br>BRK INIT: 107 KGS<br>AVE BRK DECEL: 5.6 FPS/S<br>WHEELS STOP: 249:13:38:54Z<br>12785 FT<br>ROLLOUT: 10270 FT<br>60 SEC<br>WINDS: O H/T, O X KNOTS<br>OFFICIAL: 2H, 2L<br>DENS ALT: 3400 FT<br>FLT DURATION: 6:00:56:04<br>144:56:04<br>S/T: 73:03:38:50<br>OV-103: 6:00:56:04<br>DISTANCE: 2,210,000 sm | 104/104<br>109<br>100/104/<br>84/65/<br>104/65<br>1 = 2109 (3)<br>2 = 2018 (2)<br>3 = 2021 (1)<br>M 3 EOM<br>WEIGHT: 202317<br>X CG: 1090.7<br>LANDING<br>WEIGHT: 201675<br>X CG: 1091.7 | BI-011<br>SRM: HPM<br>CASE: LWC<br>LWT-6<br>ET-13<br>ET RPT<br>245K<br>45:45<br>MET<br>ETBR/UP<br>197K<br>46:57<br>MET<br>ET<br>IMPACT<br>LAT: 28.3°S<br>LONG: 80.0°E | 28.489°<br>(8) | STANDARD<br>INSERTION<br>INSERTION<br>ALTITUDE: 160 NM<br>160.8 X<br>160.8 NM<br>POST OMS-2<br>161.63 X<br>160.95 NM<br>SBS DEPLOY<br>161.43 NM<br>(REV 6)<br>SYNCOM<br>DEPLOY<br>170.48 NM<br>(REV 17)<br>TELSTAR<br>DEPLOY<br>174.94 NM<br>(REV 34)<br>DEORBIT<br>159 X 157 NM<br>VELOCITY<br>25776 FPS<br>RANGE<br>4112 NM | OI-4<br>(1)<br>CARGO: 47516 lbs<br>CHARGEABLE: 41382 lbs<br>DEPLOYED: 30086 lbs<br>NON-DEPLOYED: 10122 lbs<br>MIDDECK: 1174 lbs<br>RETURNED: 17436 lbs<br>SHUTTLE<br>ACCUMULATED WEIGHTS: 141080 lbs<br>DEPLOYED: 184646 lbs<br>CARGO TOTAL: 375968 lbs<br>PERFORMANCE MARGINS (LBS): FPR: 4987<br>FUEL BIAS: 1341<br>FINAL TDDP:-1611<br>RECON: -1564<br>PRIMARY: SBS-D/PAM-D (DEPLOYED)<br>TELESTAR 3-C/ PAM-D (DEPLOYED)<br>SYNCOM-IV-2 (DEPLOYED)<br>OAST-1/MPRESS: SOLAR ARRAY EXPERIMENT CFES (MIDDECK) IMAX 70MM CAMERA RME CLOUDS STUDENT EXP. SSIP-FSA EXP.<br>4 CRYO TANK SETS<br>RMS 8 (S.N. 301) Used for PKM burn viewing and water dump nozzle survey and ice removal | KSC W/D: OPF 123 (2), VAB 15 (3), PAD 72 (2) = 210<br>LAUNCH POSTPONEMENT: - 6/22/84 launch postponed 3 days to 6/25/84 because of debonded engine shield during FRF.<br>LAUNCH SCRUBS/PAD ABORT #1: - 6/25/84 launch scrubbed at T-20 minutes because GPC 5 (BFS) exhibited two parity errors at T-32 minutes. Rescheduled launch for 6/26/84.<br>- 6/26/84 launch aborted at T-4 seconds when SSME #3 Main Fuel Valve failed the valve position check. (PAD abort #1.)<br>- Rolled back to VAB and re-manifested, combining STS 41-D and STS 41-F P/L's. SSME 2021 replaced 2017. Launch slip of 63 days.<br>- 8/29/84 launch scrubbed because MEC would not process certain critical events commands. Implemented a software patch to assure all 3 SRB fire commands are issued in proper order. 69-day total slip.<br>LAUNCH DELAYS: - 6 M50 S delay at T-9 because of KSC GLS problems and two private planes in launch danger area.<br>FLIGHT DURATION CHANGES: None.<br>TAL WX: DAKAR & MORON go.<br>FIRSTS:<br>- First flight of Discovery<br>- First flight to deploy 3 payloads.<br>- First flight with commercial company P/S.<br>SIGNIFICANT ANOMALIES:<br>- CRT-2 failed (IFM replaced DU-2 with DU-4)<br>- Supply/waste water nozzle iced. (12 inches in diameter by 27 inches tapered to point).<br>- Ice from supply water nozzle removed using RMS impact Unable to dump waste water for remainder of flight.<br>- O <sub>2</sub> leak (30 lbs/hr).<br>- Fuel cell performance monitor failed.<br>- Vehicle pulled to right after NLGTD. Schrader valve leaking GN <sub>2</sub> caused compressed strut.<br>- S-band Quad antenna (ULF) (switch was R & R'ed postflight).<br>- Five microswitch anomalies in RCS & OMS.<br>- RH SRM forward field joint erosion.<br>- LH SRM gas leak and erosion to primary O-ring of nozzle-to-case joint (blowby). |   |
| SEQ<br>FLT # 12  |  |   |   |  |  |   |                |   |   |  |   |
| KSC 12   | OMS PODS<br>LPO3 - 2<br>RPO3 - 1<br>FRC3 - 1 |   |   |  |  |   |                |   |   |  |   |
| PAD<br>39A-12  |  |   |   |  |  |   |                |   |   |  |   |
| <div></div> <div></div> <div>41D-12-034: Crew members (cc from ctr) CDR/ Hartsfield, PLT/Coats, MS/Hawley, MS/Resnik, PS/Walker, &amp; MS/Mulane</div> <div>41D-37-050 -- Telstar, last of three satellites deployed.</div> <div></div> |  |   |   |  |  |   |                |   |   |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

[illegible]

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.           | ORBITER                   | CREW (5)  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG  | SRB RSRM  | ORBIT          |  | FSW         | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|-------------------|---------------------------|---|--|--|--|---|----------------|--|-------------|--|--|
| STS 51-A (STS-19) | OV-103 Flight 2 Discovery | CDR: Frederick H. Hauck (Flt 2 - STS-7) P56/R17/V7/M17<br>PLT: David M. Walker P57/R48/M45<br>M/S: Joseph P. Allen (Flt 2 - STS-5) P58/R12/V8/M12<br>M/S: Anna L. Fisher P59/R49/F4<br>M/S: Dale A. Gardner (Flt 2 - STS-8) P60/R23/V9/M22<br><br>UNTETHERED EVA'S (MMU): EV1=Allen EV2=Gardner<br><br>EVA1-6:13 11/12/84 - SS EVA #7<br>EVA2-6:01 11/14/84 - SS EVA #8<br>CAPTURE AND STOW OF PALAPA-B & WESTAR-IV<br>FREE FLYER EVA'S #5 & #6 | KSC 39A<br>313:12:15:00Z<br>7:15:00 AM EST (P)<br>7:15:00 AM EST (A)<br>Thursday 4<br>11/8/84 (4)<br><br>LAUNCH WINDOW:<br>18 Minutes<br>PLANAR WINDOW (MAX YAW<br>STEERING MPS<br>LIMIT 1000 LBS<br>FOR RENDEZVOUS)<br><br>PLS - KSC<br>TAL - DAKAR (Selected)<br>TAL WX - MORON<br>AOA - EDW<br>AOA WX-NOR,KSC<br><br>MAX Q = 651<br>M = 1.10<br><br>SRB SEP:<br>2:05.72 MET<br><br>MECO:<br>8:33.16 MET<br><br>ET SEP:<br>8:51.29 MET<br><br>OMS-1:<br>10:33.3 MET<br>150.7 Seconds<br><br>OMS-2:<br>44:43 MET<br>114.8 Seconds | KSC 15 (KSC 3)<br>6:59:56 AM EST<br>Friday 3<br>11/16/84 (3)<br><br>XRANGE: 486 NM<br><br>ORB DIR: DL9<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 2724 FT<br>321:11:59:56Z<br>VEL: 194 KGS<br>192 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 195:<br>2454 FT<br><br>NLGTD: 6380 FT<br>321:12:00:09Z<br>VEL: 160 KGS<br>HDOT: -4.6 FPS<br><br>BRK INIT: 142 KGS<br><br>AVE BRK DECEL:<br>6.5 FPS/S<br><br>WHEELS STOP:<br>321:12:00:54Z<br>12178 FT<br><br>ROLLOUT:<br>9461FT<br>58 SEC<br><br>WINDS:<br>4 H, 0 X KNOTS<br>OFFICIAL: 2T, 1R<br><br>DENS ALT: -100 FT<br><br>FLT DURATION:<br>7:23:44:56<br>191:44:56<br><br>S/T: 89:08:47:24<br><br>OV-103:<br>14:00:41:00<br><br>DISTANCE:<br>2,870,000 sm | 104/104<br>109<br><br>100/89/<br>67/104/<br>65<br><br>1 = 2109 (4)<br>2 = 2018 (3)<br>3 = 2012 (6)<br><br>M 3 EOM<br><br>WEIGHT:<br>207983<br><br>X CG: 1081.4<br><br>LANDING<br><br>WEIGHT:<br>207506<br><br>X CG: 1082.6 | BI-014<br>61-84<br><br>SRM:<br>HPM<br>LWC<br><br>136 FT<br>Chutes<br><br>LWT-9<br><br>ET RPT<br>226K<br>47:06<br>MET<br><br>ET<br>IMPACT<br>LAT:<br>27.7°S<br>LONG:<br>82.0°E | 28.487°<br>(9) | STANDARD<br>INSERTION<br><br>INSERTION<br>ALTITUDE:<br><br>POST OMS-2<br>161.22 X<br>151.17 NM<br><br>TELESAT<br>DEPLOY<br>163.48 NM<br><br>SYNCOM<br>DEPLOY<br>168.14 NM<br><br>PALAPA<br>RETRIEVE<br>194.44 NM<br><br>WESTAR<br>RETRIEVE<br>189.55 NM<br><br>DEORBIT<br>191 X<br>188 NM<br><br>VELOCITY<br>25870 FPS<br><br>RANGE<br>4141 NM | OI-4<br>(3) | CARGO:<br>45306 lbs<br><br>PAYLOAD<br>CHARGEABLE:<br>38003 lbs<br><br>DEPLOYED:<br>22764 lbs<br><br>NON-DEPLOYED:<br>15052 lbs<br><br>MIDDECK:<br>187 lbs<br><br>RETRIEVED:<br>2381 lbs<br><br>RETURNED:<br>24883 lbs<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>168793 lbs<br>NON-DEPLOYED:<br>212528 lbs<br>CARGO TOTAL:<br>444739 lbs<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4633<br>FUEL BIAS: 1566<br>FINAL TDDP: 281<br>RECON: 1003<br><br>SYNCOM IV-1<br>(DEPLOYED)<br><br>TELESAT-H/<br>ANIK-D2/PAM-D<br>(DEPLOYED)<br><br>PALAPA-B2-<br>(RETRIEVED &<br>RETURNED)<br><br>WESTAR-IV -<br>(RETRIEVED &<br>RETURNED)<br><br>RME<br>DMOS-3M EXP.<br>MMU (2), EMU (3)<br><br>4 CRYO TK SETS<br><br>RMS 10 (S.N. 301)<br>Used for PALAPA/<br>WESTAR capture<br>and berth, waste<br>water dump monitor,<br>and SYNCOM and<br>TELESAT PKM<br>viewing | KSC W/D: OPF 34, VAB 5, PAD 17 = 56<br><br>VEHICLE CHANGE:<br>- OV-103 replaced OV-099 (TPS screened deterioration caused by waterproofing).<br><br>LAUNCH POSTPONEMENT: None.<br><br>LAUNCH SCRUBS:<br>- 11/7/84 launch scrubbed because winds aloft exceeded Orbiter structural limits (excessive wind shear)<br>- 1-day slip.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX:<br>- Dakar GO, Moron NO GO - low clouds.<br><br>FLIGHT DURATION CHANGES: None.<br><br>FIRSTS:<br>- First retrieval and return of satellites. PALAPA-B AND WESTAR-IV were deployed on STS 41-B but PAM Upper Stages failed.<br>- EVA crewmen captured spacecrafts using MMU/Stinger and stowed in payload bay.<br><br>RENDEZVOUS 3 & 4:<br>- To capture and return PALAPA & WESTAR.<br><br>SIGNIFICANT ANOMALIES:<br>- APU 2 water spray valve system A failed.<br>- CRT 4 failed.<br>- RCS F4R fuel leak.<br>- Both left side EMU helmet lights failed (Bad Batteries).<br>- Arriflex 16mm camera failed (IFM bypassed failed microswitch).<br>- FWD RCS Manifold 3 fuel and oxidizer Iso valves lost open indications.<br>- LRCS Sys B Fuel tank Iso Valve for manifold 3/4/5 lost open indication.<br>- PLB blankets and metal discolored.<br>- Brake hydraulic pressure increased when Iso valves opened at 200K (Iso valve leak).<br><br>IFM's - Arriflex camera repaired, EVA helmet light repaired and DAP key changeout |





S84-40082 -- CDR Hauck, seated, PLT Walker, stands next to the Eagle, 51-A mascot. Others on back row, l. to r., are Gardner/MS, Fisher/MS & Allen/MS.

51A-104-0046: Gardner donned MMU for traverse to Westar VI for first satellite retrieval, by he and Allen, for return to Earth.




# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER  | CREW (5)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br><br>AND<br>ET   | ORBIT  |  | FSW         | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|--|---|--|--|---|--|--|--|-------------|--|---|
| STS 51-C<br>(STS-20)<br><br>SEQ<br>FLT # 15<br><br>KSC 15<br><br><u>PAD</u><br>39A-15 | OV-103<br>Flight 3<br>Discovery<br><br><u>OMS PODS</u><br>LPO3 - 4<br>RPO3 - 3<br>FRC3 - 3 | CDR:<br>Thomas. K. Mattingly<br>(Flt 2 - STS-4)<br>P61/R7/V10/M7<br><br>PLT:<br>Loren J. Shriver<br>P62/R50/M46<br><br>M/S:<br>Ellison S. Onizuka<br>P63/R51/M47<br><br>M/S:<br>James F. Buchli<br>P64/R52/M48<br><br>P/S:<br>Gary E. Payton<br>P65/R53/M49 | KSC 39A<br>24:19:50:00Z<br>2:50:00 PM EST<br>Thursday 5<br>1/24/85 (1)<br><br>PLS - KSC<br>SLS - EDW<br>TAL - DAKAR<br>TAL ALT: Zaragoza<br>(Selected)<br>TAL WX - MORON | KSC 15<br>(KSC 4)<br><br>4:23:23 PM EST<br>Sunday 2<br>1/27/85 (1)<br><br>X <u>RANGE</u> : 380 NM<br><br><u>ORB DIR</u> : DL 10<br><br><u>AIM PT</u> : CLOSE IN<br><br>MLGTD: 2753 FT<br>27:21:23:23Z<br>VEL: 179 KGS<br>185 KEAS<br>HDOT: -1FPS<br><br>NLGTD: 5752 FT<br>27:21:23:35Z<br>VEL: 146 KGS<br>HDOT: -3.9 FPS<br><br><u>TD NORM 195</u> :<br>1853 FT<br><br><u>BRK INIT</u> : 117 KGS<br><br><u>AVE BRK DECEL</u> :<br>8.9 FPS/S<br><br><u>WHEELS STOP</u> :<br>27:21:24:13Z<br>10105 FT<br><br><u>ROLLOUT</u> :<br>7370 FT<br>50 SEC<br><br><u>WINDS</u> :<br>8H, 0 X KNOTS<br>OFFICIAL: 8H, 1R<br><br><u>DENS ALT</u> : -100 FT<br><br><u>FLT DURATION</u> :<br>3:01:33:23<br>73:33:23<br><br><u>S/T</u> : 92:10:20:47<br><br><u>OV-103</u> :<br>17:02:14:23<br><br><u>DISTANCE</u> :<br>1,242,566 sm | 100/92/<br>65/104/<br>65<br><br>1 = 2109 (5)<br>2 = 2018 (4)<br>3 = 2012 (7)<br><br><u>M 3 EOM</u><br><br>WEIGHT:<br><br>X CG:<br><br><u>LANDING</u><br><br>WEIGHT:<br>197700<br><br>X CG: 1091.8 | BI-015<br><br>MTR:<br>HPM<br><br>CASE:<br>LWC<br><br>115 FT<br>Chutes<br><br>LWT-7<br><br>ET-14<br><br><u>ET RPT</u><br>239K<br>46:11 MET<br><br><u>ET BR/UP</u><br>227K<br>46:31 MET<br><br><u>ET IMPACT</u><br><u>LAT</u> :<br>28.1°S<br><u>LONG</u> :<br>78.3°E | 28.45°<br>(10)   |  | OI-4<br>(4) | DOD<br><br><u>PERFORMANCE</u><br><u>MARGINS (LBS)</u> :<br>FPR:<br>FUEL BIAS:<br>FINAL TDDP: --<br>RECON: -1457<br><br>ARC<br>SFMD<br>TRE<br><br>VISION<br>FLUID SHIFT<br>OCEANS<br>OASIS-1<br>CLOUDS<br>AFT-T<br>IOCM<br><br>RMS 11 (S.N. 301)<br>Used to monitor<br>IUS/SRM burn | <u>KSC W/D</u> : OPF 31, VAB 5, PAD 20 = 50<br><br><u>LAUNCH POSTPONEMENT</u> : None.<br><br><u>LAUNCH SCRUBS</u> :<br>- 1/23/85 launch was scrubbed prior to ET tanking due to cold weather with potential for acreage ice on ET. 1-day slip.<br><br><u>LAUNCH DELAY</u> :<br>Launch delay caused by right I/B elevon not in expected position.<br><br><u>TAL WX</u> :<br>- Dakar & Moron NO GO - haze. Zaragoza GO.<br><br><u>FLIGHT DURATION CHANGES</u> : Yes.<br><br><u>SIGNIFICANT ANOMALIES</u> :<br>- Right inboard elevon CH4 secondary delta pressure force flight prelaunch (cleared when APU's to full pressure).<br>- IMU 1 and 3 excessive bias.<br>- GHE leak in T-O umbilical.<br>- FWD RCS dilemma during deorbit.<br>- BFS did not proceed to MM104 after ET sep.<br>- BFS deorbit ignition time was 8 seconds late.<br>- TACAN 3 did not lock up.<br>- RA2 erratic at high altitude.<br>- TPS had long gouge under left wing.<br>- RH SRM primary O-ring gas leak and erosion at center field joint (blowby).<br>- LH SRM forward field joint gas leak and erosion to primary O-ring (blowby). |
|      |  |   |  |  |   |  |  |  |             |  |   |
| S84-43708: STS-51C Crew & Patch   |  |   |  |  |   |  |  |  |             |  |   |
|   |  | MCC FCR-2 (9)<br><br><u>FLIGHT DIRECTORS</u><br>Ascent - J. H. Greene<br>Ld/Orb - T.W. Holloway<br>Plng - C. W. Shaw<br>Orb/Ent - T. C. Lacefield<br>MOD - E. F. Kranz  |  |  |   |  |  |  |             |  | 51C-08-023: Onizuka (left) & Shriver give thumbs up from Mid-Deck for first Department of Defense Shuttle mission.  |




# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER                        | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET                            | ORBIT |  | FSW  | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--------------------------------|---|--|--|---|---|-------|--|------|--|--|
| STS 51-E<br>(STS-22)<br><br>SEQ<br>FLT #<br><br>PAD | OV-099<br>Flight<br>Challenger | <u>CDR:</u><br><br>Karol J. Bobko<br><br><u>PLT:</u><br><br>Donald E. Williams<br><br><u>M/S:</u><br><br>M. Rhea Seddon<br><br><u>M/S:</u><br><br>S. David Griggs<br><br><u>M/S:</u><br><br>Jeffrey A. Hoffman<br><br><u>P/S:</u><br><br>Patrick Baudry<br>(French)<br><br><u>P/S:</u><br><br>Jake Garn<br>(U.S. Senator from Utah)<br><br><br><u>FLIGHT DIRECTORS:</u><br>Asc/Ent - T. C. Lacefield<br>Orbit 1 - C. W. Shaw<br>Ld/Orb 2 - B. R. Stone<br>Planning - J. M. Heflin |  |  |   | <u>MTR:</u><br><br><u>CASE:</u><br>STD<br><br>ET-17 |       |  | OI-5 | <u>CARGO:</u><br><br><u>CHARGEABLE :</u><br><br><br>TDRS-B/IUS-2<br>TELESAT-I/PAM-D<br>FEE<br>FPE<br>PPE | <u>KSC W/D:</u> OPF 57, VAB 8 (2), PAD 17 (2) = 82 days total<br><br><u>LAUNCH POSTPONEMENT:</u><br>- Launch rescheduled from 2/20/85 to 2/27/85 due to tile replacement caused by deteriorated screed on OV-099.<br>- Launch rescheduled to 3/3/85 due to LH2 primary seal leak (17" ET/Orbiter) but decision was made that secondary seal would hold.<br><br><u>LAUNCH SCRUBS:</u><br>- Flight canceled on 3/7/85 due to a TDRS-B problem and TELESAT-I was remanifested on OV-103 STS-51D. (Challenger was destacked.)<br><br>- ROLLED BACK TO VAB, CHANGED PAYLOAD TO SPACELAB 3 FOR STS 51-B.<br><br>- THESE DATA ARE INCLUDED BECAUSE THE FLIGHT WAS SCRUBBED AFTER GOING THROUGH ALL OF THE FLIGHT REVIEWS, ETC.<br><br>- 17-INCH LH <sub>2</sub> PRIMARY SEAL REDESIGNED REDUCING WIDTH & DEPTH WITH STS 61-A AS FIRST FLIGHT. |



### JSC Flight Directors of 1984

(Left to right) Front row: Milt Heflin, Bill Reeves, Chuck Lewis, Al Pennington, & Cleon Lacefield.  
Middle row: Jay Greene, Gary Coen, John Cox, & Harold Draughon.  
Back row: Randy Stone, Chuck Shaw, Tommy Holloway, Chuck Knarr, Larry Bourgeois, & Lee Briscoe.





## JSC Flight Directors of 1984

(Left to right) Front row: Milt Heflin, Bill Reeves, Chuck Lewis, Al Pennington, & Cleon Lacefield.  
 Middle row: Jay Greene, Gary Coen, John Cox, & Harold Draughon.  
 Back row: Randy Stone, Chuck Shaw, Tommy Holloway, Chuck Knarr, Larry Bourgeois, & Lee Briscoe.





## Page 2-17 - STS 51-D



[illegible]

## Page 2-18 - STS 51-B



[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY



| FLT NO.  | ORBITER  | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM<br><br>AND ET  | ORBIT  |   | FSW  | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|---|---|--|---|---|--|---|--|---|---|
| STS 51-G (STS-25)<br><br>SEQ FLT # 18<br><br>KSC 18<br><br>PAD 39A-18                | OV-103 Flight 5 Discovery<br><br>OMS PODS LPO4 - 1 RPO3 - 5 FRC3 - 5 | CDR:<br>Daniel C. Brandenstein (Flt 2 - STS-8)<br>P80/R21/V16/M20<br>PLT:<br>John O. Creighton P81/R63/M58<br>M/S:<br>John M. Fabian (Flt 2 - STS-7)<br>R82/R18/V17/M18<br>M/S:<br>Steven R. Nagel P83/R64/M59<br>M/S:<br>Shannon W. Lucid P84/R65/F6<br>P/S:<br>Patrick Baudry (France)<br>P85/R66/M60<br>P/S:<br>Sultan S. Al-Saud (Saudia Arabia)<br>P86/R67/M61 | KSC-39A<br>168:11:33:00Z<br>7:33:00 AM EDT (P)<br>7:33:00 AM EDT (A)<br>Monday 5<br>6/17/85 (3)<br><br>LAUNCH WINDOW:<br>4 minutes (CLOSE ON MORELOS EARTH HORIZON SENSOR CUTOUT - 10 MINUTES WITH WAIVER OF CUTOUT)<br><br>NEOM - EDW<br>EOM WX - KSC<br>RTL5 - KSC<br>TAL - DAKAR (Selected)<br>TAL WX - MORON<br>AOA - EDW<br>AOA WX - NOR/KSC<br><br>MAX Q = 648<br>M = 1.24<br><br>SRB SEP:<br>2:04.68 MET<br><br>MECO:<br>8:35.77 MET<br><br>ET SEP:<br>8:53.93 MET<br><br>OMS-1:<br>NONE<br><br>OMS-2:<br>40:29 MET<br>179.4 Seconds | EDW 23, LAKEBED (EDW 12, LKBD 8)<br><br>6:11:52 AM PDT Monday 3<br>6/24/85 (2)<br><br>XRANGE: 694 NM<br><br>ORB DIR: DL 12<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 1117 FT<br>175:13:11:52.4Z<br>VEL: 202 KGS 198 KEAS<br>HDOT: -2 FPS<br><br>TD NORM 195: 1387 FT<br><br>NLGTD: 4990 FT<br>175:13:12:05Z<br>VEL: 163 KGS<br>HDOT: -8 FPS<br><br>BRK INIT: 154 KGS<br><br>AVE BRK DECEL: 8.8 FPS/S<br><br>WHEELS STOP: 775:13:12:33Z<br>8550 FT<br><br>ROLLOUT: 7433 FT<br>36 SEC<br><br>WIND: 2H,11L KNOTS<br>OFFICIAL: 2H, 11L<br><br>DENS ALT: 3727 FT<br><br>FLT DURATION: 7:01:38:52<br>169:38:52<br><br>S/T: 113:12:03:48<br><br>OV-103: 31:03:48:38<br><br>DISTANCE: 2,500,000 sm | 104/104<br>109 %<br><br>100/104/<br>83/65/<br>104/65<br><br>1 = 2109 (7)<br>2 = 2018 (6)<br>3 =2012 (9)<br><br>M 3 EOM<br><br>WEIGHT: 204321<br><br>X CG: 1082.1<br><br>LANDING<br><br>WEIGHT: 204169<br><br>X CG: 1083.7 | BI-019<br><br>MTR: HPM<br><br>CASE: MWC<br><br>ET-20<br>LWT-13<br><br>ET RPT 233K<br>1:19:15<br>MET<br><br>ET BR/UP 219K<br>1:19:38<br>MET<br><br>ET IMPACT LAT: 14.89°N<br>LONG: 159.5°W | 28.487° (12)<br><br>START:<br><br>END:<br><br>MAX:<br><br><br><br>ARABSAT DEPLOY 193.81 NM<br><br>TELESTAR DEPLOY 196.35 NM<br><br>SPARTAN DEPLOY 210.3 NM<br><br>DEORBIT 191 x 150 NM<br><br>VELOCITY RANGE 25850 FPS 4050 NM | OI-6 (1)<br><br>CARGO: 44477 lbs.<br>CHARGEABLE: 38258 lbs<br>DEPLOYED: 22832 lbs<br>NON-DEPLOYED: 14866 lbs<br>MIDDECK: 560 lbs<br>RETURNED: 21310 lbs<br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 214306 lbs<br>NON-DEPLOYED: 264768 lbs<br>CARGO TOTAL: 556387 lbs<br>PERFORMANCE MARGINS (LBS): FPR: 5088<br>FUEL BIAS: 849<br>FINAL TDDP: 160<br>RECON: -1664<br>PRIMARY: TELESTAR-3D/ PAM-D DEPLOYED<br>MORELOS-A/ PAM-D DEPLOYED<br>ARABSAT-A/ PAM-D DEPLOYED<br>SPARTAN-101DH (DEPLOYED & RETRIEVED)<br>FEE, ADSF, FPE, HPTE, ASE<br>GAS: G027-OVFLR<br>G028-OVFLR<br>G471-GSFC<br>OLLENDORF<br>G025-ERNO<br>G034-EL PASO/YSLATA<br>G314-USAF/NRL<br><br>4 CRYO TNK SETS<br>RMS 13 (S.N. 301) Used for SPARTAN deploy, retrieve, and berth, water dump survey, PKM monitoring, and ARABSAT solar array survey | KSC W/D: OPF 37, VAB 7, PAD 14 = 58<br><br>LAUNCH POSTPONEMENTS:<br>- 6/12/85 launch postponed to 6/14/85 due to late OPF start.<br>- 6/14/85 launch postponed to 6/17/85 because STS 51-D landed at EDW not KSC.<br>- 2 day extension<br>- 5-day total slip.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX: Dakar & Moron go.<br><br>FLIGHT DURATION CHANGES: None.<br><br>EVENTS:<br>- MORELOS deployed orbit 6D.<br>- ARABSAT deployed orbit 18D.<br>- TELESTAR deployed orbit 32D.<br>- SPARTAN deployed orbit 51D.<br>- Rendezvous with SPARTAN.<br>- Wheels dug into lakebed » 6 inches at end of rollout.<br><br>RENDEZVOUS 6:<br>- With SPARTAN for retrieval and return.<br><br>SIGNIFICANT ANOMALIES:<br>- WCS Fan Separator 1 motor current high.<br>- RCS microswitch problems.<br>- Right RCS fuel x-feed valve 3/4/5.<br>- Left RCS OX or Fuel Tank Iso Valve.<br>- Right RCS OX Tank Iso Valve 3/4/5.<br>- S-Band lower left antenna beam switch intermittent.<br>- MDM FA3 failure (Intermittent output from secondary core power supply).<br>- WOW dilemma (wheel off ground 800 ft).<br>- RA2 late acquisition.<br>- TPS debris hits.<br>- Gas leaks and erosion on both SRM nozzle-to-case joints (blowby). |   |   |
|     |  |   |   |  |   |   |  |   |  |   |   |
| S85-32877: STS-51G Crew & Patch  |  |   |   |  |   |   |  |   |  |   |   |
|  |  | MCC FCR-2 (11)<br><br>FLIGHT DIRECTORS<br>Asc/Ent - T. C. Lacefield<br>Ld/O 1 - L. S. Bourgeois<br>O 2 - J. M. Hefflin<br>Plng - C. R. Knarr<br>MOD - T. W. Holloway  |   |  |   |   |  |   |  |   |   |
|  |  | 51g-s-225: Landing at EDW Lakebed.<br>Wheels dug into lakebed » 6 inches at end of rollout.   |   |  |   |   |  |   |  |   |   |

## Page 2-20 - STS 51-F

| FLT NO.           | ORBITER                      | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM<br><br>AND ET   | ORBIT       |  | FSW        | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|-------------------|------------------------------|--|--|--|---|--|-------------|--|------------|--|---|
| STS 51-F (STS-26) | OV-099 Challenger (Flight 8) | CDR:<br>C. Gordon Fullerton (Flt 2 - STS-3)<br>P87/R6/V18/M6<br>PLT:<br>Roy D. Bridges P88/R68/M62<br>M/S:<br>F. Story Musgrave (Flt 2 - STS-6)<br>P89/R15/V19/M15<br>M/S:<br>Anthony W. England P90/R69/M63<br>M/S:<br>Karl G. Henize P91/R70/M64<br>P/S:<br>Loren W. Acton P92/R71/M65<br>P/S:<br>John-David F. Bartoe P93/R72/M66<br><br>MCC FCR-1 (8)<br>FLIGHT DIRECTORS<br>Asc/Ent - T. C. Lacefield<br>O 1 - G. A. Pennington<br>Ld/O 2 - J. T. Cox<br>O 3 - A. L. Briscoe<br>MOD - E. F. Kranz | KSC 39A<br>210:21:00:00Z<br>3:23:00 PM EDT (P)<br>5:00:00 PM EDT (A)<br>Monday 6<br>7/29/85 (1)<br><br>LAUNCH WINDOW:<br>2 Hours, 25 Minutes<br>CREW WORKDAY<br>3 Hours, 50 Minutes<br>launch clearance and service window<br><br>PLS - EDW<br>SLS - KSC<br>AOA - NOR<br>AOA WX - KSC<br>TAL - ZARAGOZA (Selected)<br>TAL WX - MORON<br><br>MAX Q = 762<br>M = 1.63<br><br>SRB SEP:<br>2:05.24 MET<br><br>MECO:<br>9:41.24 MET<br><br>ET SEP:<br>9:59.29 MET<br><br>ABORT-TO-ORBIT<br><br>OMS-1:<br>11:41 MET<br>106.4 Seconds<br><br>OMS-2:<br>33:00 MET<br>121.8 Seconds | EDW 23, LAKEBED (EDW 13, LKBD 9)<br><br>12:45:26 PM PDT Tuesday 4<br>8/6/85 (1)<br><br>XRANGE: 603 NM<br><br>ORB DIR: AL 3<br><br>AIM PT: NOM<br><br>MLGTD: 3713 FT<br>218:19:45:26Z<br>VEL: 204 KGS<br>199 KEAS<br>HDOT: -0.7 FPS<br><br>TD NORM 195: 4073 FT<br><br>NLGTD: 6412 FT<br>218:19:45:35Z<br>VEL: 168 KGS<br>HDOT: -7.1 FPS<br><br>BRK INIT: 126 KGS<br><br>AVE BRK DECEL: 8 FPS/S<br><br>WHEELS STOP: 218:19:46:21Z<br>12282 FT<br><br>ROLLOUT: 8569 FT<br>55 SEC<br><br>WINDS: 10H, 1L KNOTS<br>OFFICIAL: 9H, 3L<br><br>DENS ALT: 5610 FT<br><br>FLT DURATION: 7:22:45:26<br>190:45:26<br><br>S/T: 121:10:49:14<br><br>OV-099: 55:07:10:16<br><br>DISTANCE: 2,850,000 sm | 104/104<br>109 %<br><br>100/104/97/65/104/91<br><br>1 = 2023 (3)<br>2 = 2020 (4)<br>3 = 2021 (4)<br><br>M 3 EOM<br><br>WEIGHT: 216894<br><br>X CG: 1079.8<br><br><br>WEIGHT: 216735<br><br>X CG: 1081.3 | BI-017<br><br>SRM: HPM<br><br>CASE: MWC<br><br>ET-19<br>LWT-12<br><br>ET<br>RPT<br>211K<br>1:03:35<br>MET<br><br>ET<br>BR/UP<br>193K<br>1:03:58<br>MET<br><br>ET<br>IMPACT<br>LAT: 48.9°S<br>LONG: 159.0°E | 49.491° (1) | 142.9 X 108.7 NM<br><br>STANDARD INSERTION WAS PLANNED<br><br>ATO AFTER SSME #1 SHUT DOWN<br><br>DEORBIT<br>174 X<br>164 NM<br>VELOCITY<br>25814 FPS<br>RANGE<br>4221 NM | OI5-24 (2) | CARGO: 34400 lbs<br><br>CHARGEABLE: 33012 lbs<br><br>DEPLOYED: 0 lbs<br><br>NON-DEPLOYED: 31257 lbs<br><br>MIDDECK: 1755 lbs<br><br>RETURNED: 33555 lbs<br><br>SHUTTLE ACCUMULATED WEIGHTS:<br>DEPLOYED: 214306 lbs<br>NON-DEPLOYED: 297780 lbs<br>CARGO TOTAL: 590787 lbs<br><br>PERFORMANCE MARGINS: NOT AVAILABLE<br><br>SPACELAB 2 WITH 13 INVESTIGATIONS IN 7 SCIENTIFIC DISCIPLINES:<br>SOLAR, ATMOSPHERIC, PLASMA, HIGH-ENERGY ASTRO-PHYSICS, IR ASTRONOMY, TECHNOLOGY RESEARCH, AND LIFE SCIENCES<br>PDP, VCAP, IRT, CRNE, XRT, SOUP CHASE, HRTS, SUSIM, PGU, SUPERFLUID HELIUM, PLASMA DEPLETION<br>PDP PROX OPS<br>SAREX, SLSTP, CBDE<br>PROX OPS WITH FREE FLYING PDP<br><br>4 CRYO TANK SETS<br><br>RMS 14 (S.N. 302)<br>Used for PDP deploy and retrieve, waste water dump monitor, and belly tile survey | KSC W/D: OPF 39, VAB 5, PAD 31 = 75<br><br>LAUNCH POSTPONEMENT: None.<br><br>LAUNCH SCRUBS/PAD ABORT #2:<br>- 7/12/85 launch aborted at T-4.2 seconds when SSME #2 (2020) chamber coolant valve (CCV) failed to ramp to 70% open by "CMD A," resulting in an MCF, causing shutdown. (pad abort #2). Recycled engine 2020 at pad.<br>- 17-day launch slip.<br><br>LAUNCH DELAYS:<br>- 1H37M delay because of an error in a TMBU CMD to BFS. BFS was Re-IPL'ed and IMU's were realigned.<br><br>TAL WX: Zaragoza go, Moron no go.<br><br>FLIGHT DURATION CHANGES:<br>- Extended flight 1 day (+ 1 rev) to provide additional Spacelab experiment time.<br><br>FIRSTS:<br>- First flight of Spacelab pallet only.<br>- First flight of IPS.<br><br>PROX OPS: With PDP.<br><br>SIGNIFICANT ANOMALIES:<br>- ROMS primary pitch TVC failed to respond properly to cmds on 7/10/85.<br>- EXP computer failed prelaunch, ECOS loaded in B/U computer.<br>- SSME #1 auto shut down at 5:43 MET. (HPFTP discharge temp B Xducer failed at 3:31 MET & Xducer A failed at 5:43) resulting in an ATO call. OMS dump (burn) of 106 seconds (4134 lbs. Prop).<br>- SSME #3 HPFTP temp B failed at 8:12 MET, inhibited limits and accomplished ATO.<br>- Recycled SSME 2020 at pad.<br>- RMS tile scan to check for ET SOFI damage to Orbiter bottom TPS (100 tiles scrapped)<br>- GPC body rate data transfer incompatible with Spacelab.<br>- Left SRB yaw axis rate Gyro assy 3 failed hardover prelaunch (GMEM patch).<br>- BFS logged "Stored Protect" after TMBU uplinked.<br>- SSME 2 GHz Pressure Xducer failed.<br>- No damage to brakes (runway inspection).<br><br>RADIATORS DEPLOYED #9 - (port side stowed 3 hours for tile survey). |
|                   |                              |  |  |  |   | 51-F-33-005:<br>Experiments & IPS<br>for Spacelab 2 are<br>backdropped against<br>the Libya/Tunisia<br>Mediterranean coast.  |             |  |            |  |   |
|                   |                              |  |  |  |   |  |             |    |            |  |   |
|                   |                              | STS-51F Flight Crew  |  |  |   |    |             |  |            |  |   |

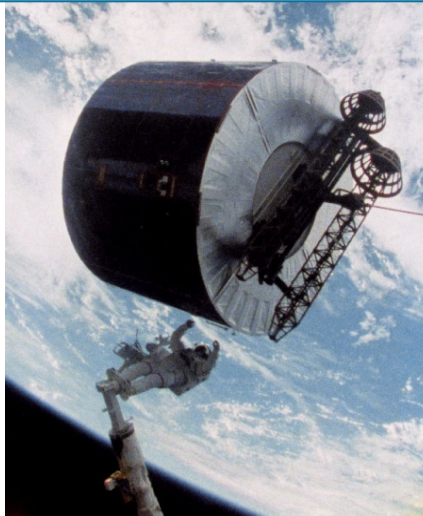
# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-21 - STS 51-I

| FLT NO.  | ORBITER   | CREW (5)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES   | LANDING SITE/<br>RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET   | ORBIT   |  | FSW  | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|--|--|--|---|--|---|--|--|---|--|
| STS 51-I<br>(STS-27)<br><br>SEQ FLT 20<br><br>KSC-20<br><br>PAD<br>39A-20  | OV-103<br>Discovery<br>(Flight 6)<br><br>OMS PODS<br>LPO4 - 2<br>RPO3 - 6<br>FRC3 - 6 | CDR:<br>Joe H. Engle<br>(Flt 2 - STS-2)<br>P94/R3/V20/M3<br><br>PLT:<br>Richard O. Covey<br>P95/R73/M67<br><br>M/S:<br>James D. Van Hoften<br>(Flt 2-STS 41-C)<br>P96/R36/V21/M35<br><br>M/S:<br>John M. Lounge<br>P97/R74/M68<br><br>M/S:<br>William F. Fisher<br>P98/R75/M69 | KSC-39A<br>239:10:58:01Z<br>6:55:00 AM EDT (P)<br>6:58:01 AM EDT (A)<br>Tuesday 2<br>8/27/85 (3)<br><br>LAUNCH WINDOW:<br>54 Minutes<br>(PLANAR/ET<br>IMPACT AREA)<br><br>PLS-EDW<br>SLS-KSC<br>ALS-NOR<br>AOA-EDW<br>AOA WX-NOR,KSC<br>TAL-DAKAR<br>TAL WX-MORON<br>(SELECTED)<br><br>MAX Q = 735 PSF<br>M = 1.61<br><br>SRB SEP:<br>2:01 MET<br><br>MECO:<br>8:27.59 MET<br><br>ET SEP:<br>8:45.77 MET<br><br>OMS-1:<br>NONE<br><br>EMU/TETHERED EVA'S:<br>EV1 - Van Hoften<br>EV2- Fisher<br><br>EVA1 = 8/31/85<br>7:20/7:07<br>SS EVA #10<br><br>EVA2 = 9/1/85<br>EV1 = 4:31/4:12<br>EV2 = 4:31/4:28<br>SS EVA #11<br>CAPTURE, REPAIR, AND<br>RELEASE OF<br>LEASAT/SYNCOM IV-4 | EDW 23, LAKEBED<br>(EDW 14, LKBD 10)<br><br>6:15:43 AM PDT<br>Tuesday 5<br>9/3/85 (3)<br><br>XRANGE:692 NM<br><br>ORB DIR: DL 13<br><br>AIM PT: NOM<br><br>MLGTD: 2101 FT<br>246:13:15:43Z<br>VEL: 175 KGS<br>191 KEAS<br>HDOT: -0.5 FPS<br><br>TD NORM 195:<br>1741 FT<br><br>NLGTD: 4384 FT<br>246:13:15:51Z<br>VEL: 144 KGS<br>HDOT: -5.6 FPS<br><br>BRK INIT: 114 KGS<br><br>AVE BRK DECEL<br>7.3 FPS/S<br><br>WHEELS STOP:<br>246:13:16:30Z<br>8201 FT<br><br>ROLLOUT:<br>6100 FT<br>47 SEC<br><br>WINDS:<br>19H, 0 X KNOTS<br>OFFICIAL: 18H, 0X<br><br>DENS ALT: 2982 FT<br><br>FLT DURATION:<br>7:02:17:42<br>170:17:42<br><br>S/T: 128:13:06:56<br><br>OV-103:<br>38:06:06:20<br><br>DISTANCE:<br>2,500,000 sm | 104/104<br>109%<br><br>100/104/<br>70/67/<br>104/103/<br>73/67<br><br>1 = 2109 (8)<br>2 = 2018 (7)<br>3 = 2012 (10)<br><br>BI-STABLE<br>HPOTP (1)<br><br>M 3 EOM<br>WEIGHT:<br>196856<br>X CG: 1092.4<br><br>LANDING<br>WEIGHT:<br>196674<br>X CG: 1094.2 | BI-020<br>MTR:<br>HPM<br><br>CASE:<br>LWC<br>ET-21<br>LWT-14<br><br>ET<br>RPT<br>232K<br>1:19:03<br>MET<br>ET<br>BR/UP<br>216K<br>1:19:29<br>MET<br>ET<br>IMPACT<br>LAT:<br>11.5°N<br>LONG:<br>157.6°W | 28.541°<br>(13)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2<br>190.51 X<br>190.2 NM<br><br>AUSSAT<br>DEPLOY<br>190.23 NM<br><br>ASC DEPLOY<br>191.6 NM<br><br>SYNCOM-F4<br>DEPLOY<br>194.6 NM<br><br>DEORBIT<br>242 X<br>178 NM<br>VELOCITY<br>25829 FPS<br>RANGE<br>4004 NM | OI6-27<br>(2)<br><br>CARGO:<br>43988 lbs<br><br>CHARGEABLE:<br>38884 lbs<br><br>DEPLOYED:<br>30289 lbs<br><br>NON-DEPLOY:<br>8221 lbs<br><br>MIDDECK:<br>374 lbs<br><br>RETURNED:<br>13478 lbs<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>244595 lbs<br>NON-DEPLOYED:<br>306375 lbs<br>CARGO TOTAL:<br>634775 lbs<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4983<br>FUEL BIAS: 839<br>FINAL TDDP: 176<br>RECON: -1145<br><br>PRIMARY:<br>ASC-1/PAM-D<br>DEPLOYED<br><br>AUSSAT-1/PAM-D<br>DEPLOYED<br><br>SYNCOM IV-4<br>UNO (LEASAT)<br>DEPLOYED<br><br>MIDDECK:<br>PVTOS<br>PFR/APC<br>MFR<br><br>4 CRYO TK SETS<br><br>RMS 15 (S.N. 301)<br>Used for LEASAT<br>capture, repair, and<br>release, waste water<br>dump monitor, and to<br>open AUSSAT<br>sunshield | KSC W/D: OPF 27, VAB 7, PAD 22 = 56<br><br>LAUNCH POSTPONEMENTS: None.<br><br>LAUNCH SCRUBS:<br>- 8/24/85 launch scheduled for 8:38 AM EDT scrubbed<br>because of thunderstorms in launch area and ship in LDA.<br>- 8/25/85 launch scrubbed because of GPC-5 failure. Re-<br>IPL's GPC-5 and fault repeated 11 minutes later. Replaced<br>GPC-5.<br>- 3-day total slip.<br><br>LAUNCH DELAYS: - 3M1S delay awaiting clearing in cloud<br>cover and ship in SRB recovery area.<br><br>TAL WX: Dakar no go - clouds, Moron go.<br><br>FLIGHT DURATION CHANGES:<br>- Shortened flight 1 day because AUSSAT was deployed<br>early.<br><br>EVENTS:<br>- Deployed AUSSAT-1 on orbit 5 instead of 17 because of<br>sunshield damage by RMS camera.<br>- Deployed ASC-1 on orbit 7 at 239:22:07:32Z.<br>- Deployed SYNCOM IV-4 on orbit 32 at 241:10:47:55z.<br>(Failed to operate after achieving operational altitude.)<br>- Rendezvous and EVA repair of LEASAT salvage<br>(SYNCOM IV-3) on days 5 and 6. (Deployed on STS 51-<br>D.)<br>- Bi-Stable Pump - HPOTP minimum throttle of 67 percent<br>(first flight.)<br><br>RENDEZVOUS 7: To repair SYNCOM IV-3 .<br><br>SIGNIFICANT ANOMALIES:<br>- Tank A water flow rate to galley low.<br>- Hydraulic System 3 accumulator bootstrap pressure low.<br>- RMS elbow joint failed to respond to computer commands<br>in primary.<br>- Potable water nozzle temp dropped to 58°F during supply<br>water dump.<br>- BFS OMS 2 out-of-plane velocity<br>computation 12.5 FPS higher than PASS.<br>- FES topping duct zone H heater B failed.<br>- FRCS thruster FIF chamber pressure failure.<br>- Rt OMS fuel tank isol vlv A barber pole.<br>- Galley water flow did not shut off.<br>- Right OMS pod AFRSI strip loose.<br><br>RADIATORS DEPLOYED #10 (one sleep period for DTO) |   |  |
| <div>STS-51I Flight Crew</div> <div></div>  |   |  |  |  |   |  |   |  |  |   |  |
| <div>51I-S-237: Syncom IV-3 after shove-off<br/>by Hoften/MS. Errant satellite was<br/>earlier captured &amp; repaired by Shuttle.</div> <div></div> |   |  |  |  |   |  |   |  |  |   |  |





STS-51I Flight Crew





## Page 2-22 - STS 51-J



| FLT NO.   | ORBITER  | CREW (5)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET  | ORBIT<br>INC<br>HA/HP |  | FSW           | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|--|---|--|---|--|---|-----------------------|--|---------------|---|---|
| STS 51-J<br>(STS-28)<br><br>SEQ.<br>FLT # 21<br><br>KSC-21<br><br><u>PAD</u><br>39A-21            | OV-104<br>Atlantis<br>(Flight 1)<br><br><u>OMS PODS</u><br>LPO3 - 6<br>RPO1 - 7<br>- 1 | <u>CDR:</u><br>Karol J. Bobko<br>(Flt 3 - STS-6 &<br>STS 51-D)<br>P99/R14/V11/M14<br><u>PLT:</u><br>Ronald J. Grabe<br>P100/R76/M70<br><u>M/S:</u><br>Robert L. Stewart<br>(Flt 2 - STS 41-B)<br>P101/R33/V22/M32<br><u>M/S:</u><br>David C. Hilmers<br>P102/R77/M71<br><u>P/S:</u><br>William A. Pailles<br>(USAF)<br>P103/R78/M72<br><br>MCC FCR-2 (13)<br><u>FLIGHT DIRECTORS:</u><br>Asc/Ent - G. E. Coen<br>O 1 - C. W. Shaw<br>Ld/O 2 - B. R. Stone<br>Plng - J. M. Hefflin<br>MOD - T. W. Holloway | KSC-39A<br>276:15:15:30Z<br><br>11:15:30 AM EDT<br>Thursday 6<br>10/3/85 (2)<br><br>PLS - EDW<br>SLS - KSC<br>TAL - Dakar<br>TAL WX - Moron<br>(SELECTED)<br>TAL WX - Zaragoza | EDW 23, LAKEBED<br>(EDW 15, LKBD 11)<br><br>10:00:08 AM PDT<br>Monday 4<br>10/7/85 (2)<br><br><u>XRANGE:</u><br>432 NM<br><br><u>ORB DIR:</u> DL 14<br><br><u>A/IM PT:</u> CLOSE IN<br><br><u>MLGTD:</u> 2476 FT<br>280:17:00:08Z<br>VEL: 187 KGS<br>192 KEAS<br>HDOT: -2 FPS<br><br><u>TD NORM 195:</u><br>2206 FT<br><br><u>NLGTD:</u> 4873 FT<br>280:17:00:15Z<br>VEL: 155 KGS<br>HDOT: -5.6 FPS<br><br><u>BRK INIT:</u> 117 KGS<br><br><u>AVE BRK DECEL:</u><br>7.3FPS/S<br><br><u>WHEELS STOP:</u><br>280:17:01:13Z<br>10532 FT<br><br><u>ROLLOUT:</u><br>8056 FT<br>65 SEC<br><br><u>WINDS:</u><br>14H, 1R KNOTS<br>OFFICIAL: 11H, 4R<br><br><u>DENS ALT:</u> 3622 FT<br><br><u>FLT DURATION:</u><br>4:01:44:38<br>97:44:38<br><br><u>S/T:</u> 132:14:51:34<br><br><u>OV-104:</u><br>4:01:44:38<br><br><u>DISTANCE:</u><br>1,682,641 sm | 104/104<br>109<br><br>100/104/<br>68/65/<br>104/102/<br>74/65<br><br>1 = 2011 (2)<br>2 = 2019 (2)<br>3 = 2017 (4)<br><br><u>M 3 EOM</u><br>WEIGHT:<br><br>X CG:<br><br><u>LANDING</u><br>WEIGHT:<br>190765<br><br>X CG: 1101.2 | BI-021<br><br><u>MTR:</u><br>HPM<br><br><u>CASE:</u><br>LWC<br>ET-25<br>LWT-18<br><br><u>ET</u><br><u>RPT</u><br>230K<br>1:23:04<br>MET<br><br><u>ET</u><br><u>BR/UP</u><br>215K<br>1:23:25<br>MET<br><br><u>ET</u><br><u>IMPACT</u><br><u>LAT:</u><br>20.6°N<br><u>LONG:</u><br>148.26°W | 28.5°<br>(14)         |  | Oi6-28<br>(3) | DOD<br><br><br>NO RMS<br><br>OASIS-2<br>CLOUDS<br>RME<br>MARC-DN<br>RTPA<br>OCEANS<br>VFT-1<br>VFT-2<br>CST<br>AMOS<br>WINCON | <u>KSC W/D:</u> OPF 84, VAB 14 PAD 34 = 132<br><br><u>LAUNCH POSTPONEMENTS:</u> None.<br><br><u>LAUNCH SCRUBS:</u> None.<br><br><u>FLIGHT DURATION CHANGES:</u> None.<br><br><u>LAUNCH DELAY:</u><br>- Launch delayed because of MPS PV# 6 RPCA erratic.<br>(LH <sub>2</sub> prevalve close indicator.)<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Port MPM shoulder "A" pyro initiator circuit failed self test.<br>- APU Exhaust Gas temp 2 failed.<br>- WSB 2 regulator pressure decayed.<br>- OPS Recorder 2 tracks 7,8, & 9 intermittent.<br>- ROMS fuel total quantity reading offset.<br>- TPS damage on left inboard elevon leading edge and in nose cap area.<br>- Fuel Cell 3 O <sub>2</sub> flowmeter failed.<br>- SSME 1 and 2 pitch and yaw actuator secondary delta pressures high.<br>- PLB camera "B" difficult to focus and camera "C" Azimuth and elevation failed.<br>- Airlock hatch "A" tapered pin did not latch in open position.<br>- Side hatch "T" handle difficult for crew to operate. |
| <div>  </div>     |  |   |  |   |  |   |                       |  |               |   |   |
| <div>  </div>   |  |   |  |   |  |   |                       |  |               |   |   |
| <div> <div>Hilmers/MS --- Pailles/PS</div> <div>Stewart/MS -- CDR Bobko -- PLT Grabe</div> </div> |  |   |  |   |  |   |                       |  |               |   |   |

## Page 2-23 - STS 61-A

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER                                      | CREW (7)   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG   | SRB RSRM AND ET   | ORBIT        |   | FSW        | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--|--|---|--|---|---|--------------|---|------------|---|---|
|   |  | TITLE, NAMES & EVA'S   |   | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N.  |   | INC          | HA/HP   |            |   |   |
| STS 61-B (STS-31)   | OV-104 Atlantis (Flight 2)                   | CDR: Brewster H. Shaw, Jr. (Flt 2 - STS-9)<br>P112/R25/V26/M24<br>PLT: Bryan D. O'Connor P113/R83/M76<br>M/S: Sherwood C. Spring P114/R84/M77<br>M/S: Mary L. Cleave P115/R85/F8<br>M/S: Jerry L. Ross P116/R86/M78<br>P/S: Charles Walker (Flt 3 - STS 41-D & STS 51-D) P117/R42/V12/M40<br>P/S: Rudolpho Neri Vela (Mexico) P118/R87/M79 | KSC 39A<br>331:00:29:00Z<br>7:29:00 PM EST (P)<br>7:29:00 PM EST (A)<br>Tuesday 3<br>11/26/85 (5)<br><br>LAUNCH WINDOW:<br>9 Minutes<br>KU-SAT B/U DPLY-AUSSAT SUN SHIELD FAIL<br><br>PLS - EDW<br>SLS - KSC<br>ALS - NOR<br>AOA - EDW<br>AOA WX - NOR, KSC<br>TAL - DAKAR (SELECTED)<br>TAL WX - MORON<br><br>MAX Q = 723 PSF<br>M = 1.16<br><br>SRB SEP:<br>2:03.56 MET<br><br>MECO:<br>8:31.29 MET<br><br>ET SEP:<br>8:49.45 MET<br><br>OMS-1:<br>NONE<br><br>OMS-2:<br>40:25 MET<br>180.4 Seconds | EDW 22, Concrete (EDW 17, CONC 5)<br><br>1:33:49 PM PST Tuesday 6<br>12/03/85 (2)<br><br>XRANGE: 533 NM<br><br>ORB DIR: AL 4<br><br>AIM PT: NOM<br><br>MLGTD: 2386 FT<br>337:21:33:49Z<br>VEL: 201 KGS<br>191 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 195: 2026 FT<br><br>NLGTD: 5909 FT<br>337:21:34:00Z<br>VEL: 160 KGS<br>HDOT: -3.6 FPS<br><br>BRK INIT: 126 KGS<br><br>AVE BRK DECEL: 7 FPS/S<br><br>WHEELS STOP: 337:21:35:07Z<br>13145 FT<br><br>ROLLOUT: 10759 FT<br>78 SEC<br><br>WINDS: 8T, 2R KNOTS<br>OFFICIAL: 4T, 4R<br><br>DENS ALT: 2551 FT<br><br>FLT DURATION: 6:21:04:49<br>165:04:49<br><br>S/T: 146:12:41:14<br><br>OV-104: 10:22:49:27<br><br>DISTANCE: 2,466,956 sm | 104/104<br>109%<br><br>100/104/<br>65/104/<br>103/74/<br>65<br><br>1 = 2011 (3)<br>2 = 2019 (3)<br>3 = 2017 (5)<br><br>M 3 EOM<br>WEIGHT: 205880<br><br>X CG: 1084.4<br><br>LANDING: WEIGHT: 205732<br><br>X CG: 1085.9 | BI-023<br><br>MTR: HPM<br>CASE: LWVC<br><br>ET-22<br>LWT- 15<br><br>ET RPT<br>231 K<br>1:19:20<br>MET<br><br>ET BR/UP<br>207 K<br>1:19:56<br>MET<br><br>ET IMPACT<br>LAT: 17.31°N<br>LONG: 156.69°W | 28.454° (15) | DIRECT INSERTION<br><br>POST OMS-2<br>191.33 X<br>190.12 NM<br><br>MORELOS DEPLOY<br>192.71 NM<br><br>AUSSAT DEPLOY<br>196.43 NM<br><br>SATCOM DEPLOY<br>197.17 NM<br><br>DEORBIT<br>209 X<br>172 NM<br>VELOCITY<br>25882 FPS<br>RANGE<br>4099 NM | OI6-30 (5) | CARGO: 47509 lbs<br><br>CHARGEABLE: 42788 lbs<br><br>DEPLOYABLE: 27465 lbs<br><br>NON-DEPLOY: 13986 lbs<br><br>MIDDECK: 1337 lbs<br><br>RETURNED: 20074 lbs<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 272210 lbs<br>NON-DEPLOYED: 351192 lbs<br>CARGO TOTAL: 714195 lbs<br><br>PERFORMANCE MARGINS (LBS): FPR: 5284<br>FUEL BIAS: 849<br>FINAL TDDP: 874<br>RECON: 2332<br><br>PAYLOADS: SATCOM KU-2/ PAM D-2 DEPLOYED<br><br>MORELOS-B/ PAM-D DEPLOYED<br><br>AUSSAT-2/PAM-D DEPLOYED<br><br>SKT EASE/ACCESS/MP ESSIMAX CFES DMOS GAS(1) MPSE<br><br>4 CRYO TANK SETS<br><br>RMS 17 (S.N. 303) Used for EASE/ACCESS assembly, PKM monitors, waste water dump monitor | KSC W/D: OPF 27, VAB 4, PAD 14 = 46<br><br>LAUNCH POSTPONEMENTS: None.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS: None.<br><br>NIGHT LAUNCH: Shuttle #2<br><br>TAL WX: Dakar go, Moron no-go - clouds.<br><br>FLIGHT DURATION CHANGES:<br>- EDW lakebed wet, changed to EDW 22 and landed one rev early due to lighting conditions on EDW 22.<br>- Shortened flight by one rev.<br><br>EVENTS:<br>- OMS-1 not performed.<br>- MORELOS deployed 331:07:46:50Z (rev 6).<br>- AUSSAT deployed 332:01:21Z (rev 17).<br>- SATCOM deployed 332:21:57:31Z (rev 31).<br>- EVA 1 - Assembled/disassembled - ACCESS ten bays and six EASE assembly/disassembly cycles.<br>- EVA 2 - Completed all tasks.<br><br>SIGNIFICANT ANOMALIES:<br>- Excess helium in cryo 02 fans 1 and 2.<br>- Fuel cell 2 performance degraded and CPM hung up.<br>- OMS XFD OX Center Heater failed.<br>- WSB #3 Reg. pressure decay.<br>- Port PLS R-T-L CLOSE A failed.<br>- Port PLBD aft.<br>- NLG Strut 3" low.<br>- Volume H locker had to be pried open.<br>- GSE side hatch "T" handle broke.<br>- Gas leaks and erosion to both nozzle-to-case joints (blowby on LH SRM).<br>- Radiators deployed #12 (deployed for 10-hour DTO) |
| SEQ FLT #23   |  |  |   |  |   |   |              |   |            |   |   |
| KSC-23  |  |  |   |  |   |   |              |   |            |   |   |
| PAD 39A-23  | OMS PODS<br>LPO3 - 7<br>RPO1 - 8<br>FRC4 - 2 |  |   |  |   |   |              |   |            |   |   |
|   |  |    |   |  |   |   |              |   |            |   |   |
| MCC FCR-2 (14)  |  |  |   |  |   |   |              |   |            |   |   |
| FLIGHT DIRECTORS:<br>Asc/Ent - G. E. Coen<br>O 1 - W. D. Reeves<br>Ld/O 2 - J. T. Cox<br>Plng - C. W. Shaw<br>MOD - D. R. Puddy |  |  |   |  |   |   |              |   |            |   |   |
|   |  |    |   |  |   |   |              |   |            |   |   |
| S85-38825 --- STS-61-B Crew Portrait  |  |  |   |  |   |   |              |   |            |   |   |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.           | ORBITER                             | CREW (7)   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE  | SSME-TL NOM-ABORT EMERG                | SRB RSRM                | ORBIT        |                    | FSW        | PAYLOAD WEIGHTS,  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|-------------------|-------------------------------------|--|--|---|--|-------------------------|--------------|--------------------|------------|---|---|
|                   |                                     | TITLE, NAMES & EVA'S   | LANDING SITES, ABORT TIMES   | LANDING TIMES FLT DURATION, WINDS                                       | THROTTLE PROFILE ENG. S.N.             | AND ET                  | INC          | HA/HP              |            | PAYLOADS/ EXPERIMENTS   |   |
| STS 61-C (STS-32) | OV-102 Columbia (Flight 7)          | CDR: Robert L. Gibson (Flt 2 - STS 41-B) P119/R30/V27/M29  | KSC 39A 12:11:55:00Z 6:55:00 AM EST (P) 6:55:00 AM EST (A) Sunday 3 1/12/86 (2)                | EDW 22, Concrete (EDW 18, CONC 6) 5:58:51 AM PST Saturday 5 1/18/86 (2) | 104/104 109%                           | BI-024                  | 28.448° (16) | STANDARD INSERTION | O17-32 (1) | CARGO: 32733 lbs  | KSC W/D: OPF 101, VAB 8, PAD 34 = 143   |
| SEQ FLT #24       |                                     |  |  |   |  | MTR: HPM                |              | POST OMS-2         |            | PAYLOAD CHARGEABLE: 28625 lbs   | LAUNCH POSTPONEMENTS: None.   |
| KSC-24            |                                     | PLT: Charles F. Bolden P120/R88/M80  |  |   | 100/104/ 85/69/ 104                    | CASE: LWC               |              | 176.13 X 175.14 NM |            | DEPLOYABLE: 12351 lbs   | LAUNCH SCRUBS:  |
| PAD 39A-24        | OMS PODS LPO4 - 3 RPO4 - 3 FRC2 - 7 | M/S: George D. Nelson (Flt 2 - STS 41-C) P121/R37/V28/M36  | LAUNCH WINDOW: 49 mins SATCOM KU THERMAL CONSTR ORBIT 8A                                       | XRANGE: 661 NM ORB DIR: DL 15 AIM PT: NOM                               | 1 = 2015 (5) 2 = 2018 (8) 3 = 2109 (9) | ET-30 LWT- 23           |              | SAT COM DEPLOY     |            | NON-DEPLOY: 15837 lbs   | - 12/18/85 launch scrubbed to complete RCS crossfeed work in aft compartment (rescheduled before PRSD loading). 1-day slip.   |
|                   |                                     | M/S: Steven A. Hawley (Flt 2 STS 41-DR) P122/R39/V29/M38   | PLS - KSC SLS - EDW ALS - NOR AOA - EDW AOA WX - NOR,KSC TAL - DAKAR TAL WX - MORON (SELECTED) | MLGTD: 1530 FT 18:13:58:51Z VEL: 217 KGS HDOT: -2 FPS                   | BI-STABLE HPOTP (2)                    | ET RPT 239K 46:25 MET   |              |                    |            | MIDDECK: 437 lbs  | - 12/19/85 launch scrubbed after autohold at T-14 seconds due to RH SRB tilt HPU exceeding RPM redline (oversensitivity in control circuit). Launch rescheduled after holidays for 1/6/86. 18-day slip.   |
|                   |                                     | M/S: Franklin Chang-Diaz P123/R89/M81  |  | TD NORM 195: 2970 FT  |  | ET IMPACT               |              |                    |            | RETURNED: 20111 lbs   | - 1/6/86 launch scrubbed at T-31 seconds when GSE LO <sub>2</sub> replenish valve failed to close. Wrong manual command sequence resulted in TSM vent and drain valves opening without closing Orbiter fill/drain valve causing off-loading of approximately 18,000 lbs LO <sub>2</sub> via F/D valve. LO <sub>2</sub> SSME temperature dropped below redline limit and count recycled to T-20 minutes. Did an IMU alignment; however, launch was scrubbed when SATCOM launch window expired. |
|                   |                                     | P/S: C. W. Nelson (Congressman) P124/R90/M82   | MAX Q = 696 PSF M = 1.13   | NLGTD: 6300 FT 18:13:59:07Z VEL: 160 KGS HDOT: -3.1 FPS                 | X CG: 1083.6                           | ET BR/UP 192K 47:41 MET |              | DEORBIT            |            | SHUTTLE ACCUMULATED WEIGHTS: 284561 lbs DEPLOYED: 367466 lbs NON-DEPLOYED: 746928 lbs               | Detanked and found a broken GSE LOX temperature probe lodged in SSME #2 prevalue (would have precluded full prevalue closure). Launch rescheduled for 1/7/86. 1-day slip.   |
|                   |                                     | P/S: R. J. Cenker (RCA) P125/R91/M83   | SRB SEP: 2:07.23 MET   | BRK INIT: 138 KGS   |  | ET IMPACT               |              | VELOCITY           |            | PERFORMANCE MARGINS (LBS): FPR: 5407 FUEL BIAS: 840 FINAL TDDP: 10754 RECON: 11127                  | - 1/7/86 launch was scrubbed at T-9 hold due to bad weather at TAL sites (Dakar & Moron) and marginal KSC weather. Forty-eight hour turnaround for ovality check on MPS low pressure fuel duct. Rescheduled launch for 1/9/86. 2-day slip.  |
|                   |                                     | MCC FCR-1 (10)   | MECO: 8:21.29 MET  | AVE BRK DECEL: 7.2 FPS/S  | X CG: 1085.1                           | LONG: 81.3°E            |              | RANGE              |            |   | - 1/9/86 launch was scrubbed on 1/8/86 because of predicted bad weather at KSC. and temperature GSE probe found in SSME #2 prevalue. Rescheduled launch for 1/10/86. 1-day slip.  |
|                   |                                     | FLIGHT DIRECTORS: AscEnt - G. E. Coen Ld/O 1 - J. H. Greene O 2 - J. M. Hefflin Plng - G. A. Pennington MOD - T. W. Holloway | ET SEP: 8:39.77 MET  | WHEELS STOP: 18:13:59:50Z 11727 FT                                      |  |                         |              |                    |            | PAYLOADS: SATCOM KU- 1/ PAM D2 DEPLOYED   | - 1/10/86 launch scrubbed due to rain showers at KSC with 45 minutes remaining in window. Rescheduled launch for 1/12/86. 2-day slip.   |
|                   |                                     |  | OMS-1: 10:51 MET 164.03 Seconds ΔV = 265.8 FPS   | ROLLOUT: 10202 FT 59 SEC  |  |                         |              |                    |            | MSL-2 HITCHHIKER INFRARED - IMAGING EXP 13 GAS CANS CHAMP IBSE HPCG STUDENT EXP (3) NORMS ACIP AADS | - 25-day total slip.  |
|                   |                                     |  | OMS-2: 46.05 MET 136.38 Seconds ΔV = 216.9 FPS   | WINDS: 2T, 0X KNOTS OFFICIAL: 1H, 1R                                    |  |                         |              |                    |            | 4 CRYO TK SETS NO RMS   | LAUNCH DELAYS: None.  |
|                   |                                     |  |  | DENS ALT: 1088 FT   |  |                         |              |                    |            |   | TAL WX: Dakar no-go - dust, Moron go.   |
|                   |                                     |  |  | FLT DURATION: 6:02:03:51 146:03:51                                      |  |                         |              |                    |            |   | FIRSTS  |
|                   |                                     |  |  | S/T: 152:14:45:05   |  |                         |              |                    |            |   | - First flight of OV-102 after major mod (included removal of ejection seats and modifying display panels).   |
|                   |                                     |  |  | OV-102: 41:01:54:11   |  |                         |              |                    |            |   | Continued . . .   |
|                   |                                     |  |  | DISTANCE: 2,197,305 sm  |  |                         |              |                    |            |   |   |



61c-005-0036 -

US Rep. C.W. Nelson, from Florida, at work in space.





# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-26 - STS 61-C

| FLT NO. | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---------|---------|----------------------------------|--|--|--|-----------------|-----------------|--|-----|--|---|
|---------|---------|----------------------------------|--|--|--|-----------------|-----------------|--|-----|--|---|

STS 61-C



61C-14-0008 Crew in middeck; CDR Gibson (lower right corner), others counter-clockwise from upper right: PLT Bolden, U.S. Representative C.W. Nelson/PS, Cenker/RCA-PS, Hawley/MS, Chang-Diaz/MS, G.D. Nelson/MS



ABOVE: 61C-005-0036 -- SATCOM Ku-1 Communications Satellite deployed from Columbia.  
BELOW: 61C-S-050 (18 January 1986) --- Second Shuttle night landing. View is of the Shuttle's main landing gear touching down at EAFB with streams of light trailing behind the orbiter.



AT LEFT:  
61C-13-005 -  
- The crew, having received excellent service from the Waste Management System, showed this photo at their Jan. 23, 1986 Post-Flight Press Conference.



Continued . . .

## FLIGHT DURATION CHANGES:

- Management decision made to change flight duration to 4 days from 5 days.
- Extended flight from 4 to 5 days due to bad weather at KSC (was 1/16/86).
- Extended flight from 5 to 6 days due to bad weather at KSC (was 1/17/86).
- Waved off KSC landing on 1/18/86 due to bad weather and landed at EDW (one rev extension).
- Flight extensions, 2 days + 1 rev.

## LANDING SITE CHANGE:

- KSC to EDW.

## NIGHT LANDING:

- Second Shuttle night landing.

## EVENTS:

- SATCOM deployed at 9:32 MET (REV 7).
- Bi-stable Pump - HPOTP required minimum throttle of 67 percent (second flight).

## SIGNIFICANT ANOMALIES:



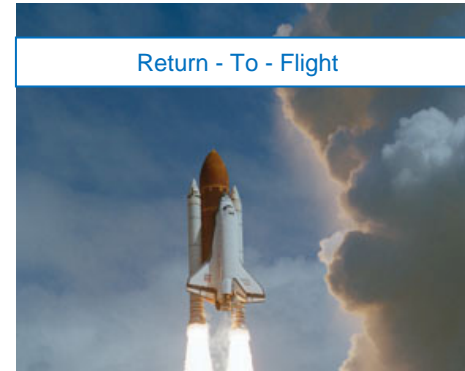
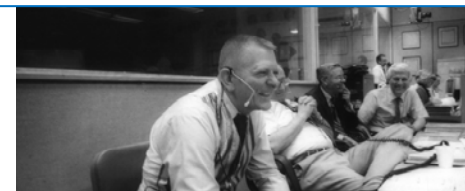
- Fuel cell power source to essential bus 1 BC erratic.
- APU 1 gearbox GN<sub>2</sub> pressure high .
- APU's 1 and 3 isolation valve temperatures low.
- APU 3 fuel line system B heater failed .
- Vernier RCS jets fired excessively .
- S-band U/L and L/R antenna performance erratic.
- ECLSS pressure control system 2 oxygen flow transducer read low.
- WSB 3 System "A" heater operation erratic.
- Left RCS Helium Reg "B" leaked.
- WSB 1 system "A" cooling water use high.
- Gas leak in LH SRM nozzle-to-case joint (blowby).
- Gas leak and erosion in RH SRM nozzle-to-case joint.



## Page 2-27 - STS 51-L

[illegible]

# SPACE SHUTTLE MISSIONS SUMMARY


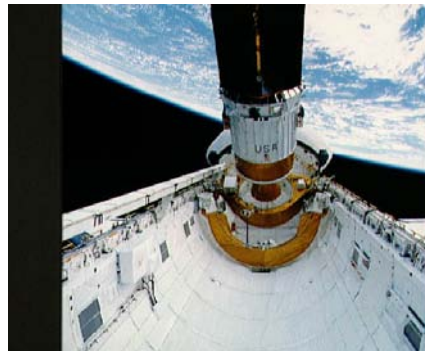
| FLT NO.  | ORBITER                                      | CREW (5)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET  | ORBIT          |   | FSW          | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|--|--|--|--|---|---|----------------|---|--------------|---|---|
| STS-26<br>(STS-26R)  | OV-103<br>(Flight 7)<br>Discovery            | CDR:<br>Frederick H. Hauck<br>(Flt 3 - STS-7 &<br>STS 51-A)<br>P133/R17/V7/M17   | KSC 39B<br>273:15:37:00Z<br>9:59:00 AM EDT (P)<br>11:37:00 AM EDT (A)<br>Thursday 7<br>9/29/88 (1)   | EDW 17L<br>(EDW 19, LKBD 13)<br><br>9:37:11 AM PDT<br>Monday 5<br>10/3/88 (3)<br><br>DEORBIT BURN:<br>277:15:34:44Z<br><br>XRANGE: 383 NM<br><br>ORB DIR: DL 16, REV 64<br><br>AIM PT: NOM<br><br>MLGTD: 2569 FT<br>277:16:37:11Z<br>VEL: 196 KGS<br>187 KEAS<br>HDOT: -0.5 FPS<br>(SR + 11 MIN)<br><br>TD NORM 195:<br>1849 FT<br><br>NLGTD: 5671 FT<br>277:37:16:18Z<br>VEL: 150 KGS<br>HDOT: -5.8 FPS<br><br>BRK INIT: 127 KGS<br><br>AVE BRK DECEL:<br>7.2 FPS/S<br><br>WHEELS STOP:<br>277:16:37:57Z<br>10020 FT<br><br>ROLLOUT:<br>7451 FEET<br>50 SECONDS<br><br>WINDS:<br>3T, 0X KNOTS<br>OFFICIAL: 5H, 1L<br><br>DENS ALT: 3445 FT<br><br>FLT DURATION:<br>4:01:00:11<br>97:00:11<br><br>S/T: 156:15:46:30<br><br>OV-103:<br>42:07:06:31<br><br>DISTANCE:<br>1,430,505 sm | 104/104<br>109%<br><br>104/102/<br>65/104/<br>65<br><br>1 = 2019 (4)<br>2 = 2022 (1)<br>3 = 2028 (1)<br><br>M 3 EOM<br>WEIGHT:<br>194347<br><br>X CG: 1096.6<br><br>LANDING:<br>WEIGHT:<br>194184<br><br>X CG: 1098.3 | BI-029<br>RSRM 1<br>360L<br>001<br><br>ET-28<br>LWT-21<br>ET RPT<br>231K<br>1:17:18<br>MET<br><br>ETBR/UP<br>211K<br>1:17:51<br>MET<br><br>ET<br>IMPACT<br>LAT:<br>12.58°N<br>LONG:<br>164.04°W | 28.46°<br>(17) | DIRECT<br>INSERTION<br><br><br><br>POST<br>OMS-2<br>162.61 X<br>169.02 NM<br><br><br><br>TDRS-C<br>DEPLOY<br>165.88 NM<br><br><br><br>DEORBIT<br>177 X<br>163 NM<br><br>VELOCITY<br>25790 FPS<br><br><br>RANGE<br>4117 NM | OI-8B<br>(1) | CARGO:<br>46448 lbs<br><br>PAYLOAD<br>CHARGEABLE:<br>44601 lbs<br><br>DEPLOYABLE:<br>37514 lbs<br><br>NON-DEPLOYED:<br>5928 lbs<br><br>MIDDECK:<br>1159 lbs<br><br>RETURNED:<br>8964 lbs<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>322075 lbs<br>NON-DEPLOYED:<br>374553 lbs<br>CARGO TOTAL:<br>793376 lbs<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 5169<br>FUEL BIAS: 949<br>TANT TDDP: 1546<br>RECON: 624<br><br>PAYLOADS:<br>PLB:<br>TDRS-C/IUS<br>DEPLOYED<br><br>OASIS-1<br><br>MIDDECK:<br>PVTOS-2<br>ADSF, IRCFE<br>PCG<br>IEF<br>PPE<br>ARC<br>MLE<br>ELRAD<br>SSIP(2)<br>SE84-4<br>SE84-5<br><br>3 CRYO TANK<br>SETS<br><br>NO RMS | KSC W/D: OPF 221, VAB 13, PAD 88 = 322<br><br>LAUNCH POSTPONEMENTS:<br>- 9/26/88 launch postponed 3 days to 9/29/88 for Orbiter aft critical path. 3-day slip.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS:<br>- 1H38M delay from 9:59 a.m. EDT due to: (1) winds aloft differed from planned autumn winds with exceedences of WLE-14R and WLE-14L, and (2) PLT and M/S 1 suit fan fuses blew (replaced with 10A fuses but intended 5 amp fuses).<br><br>FLIGHT DURATION CHANGES: None.<br><br>TAL WX:<br>- Alternate TAL Moron selected due to rain showers and crosswind violations at Ben Guerir (Prime).<br><br>FIRSTS:<br>- Return to flight 2 yrs 8 mos after STS 51-L.<br><br>EVENTS:<br>- TDRS-C deployed at 06:13:05 MET (rev 3).<br>- Two engines OMS SEP burn at 06:28:03 MET (16.6 sec, 30.85 FPS).<br>- Deorbit burn 168 secs, 324.86 FPS.<br>- ET Reentry (tumble) - CAST GLANCE violent rupture.<br><br>SIGNIFICANT ANOMALIES:<br>- Prelaunch H <sub>2</sub> leak at 4"disc.<br>- RCS dynatube repair early in flow using clamshell.<br>- OMS gimbal standby enable 1 fail.<br>- FES high load evap freezing during ascent. FES shutdown during entry after OMS deorbit burn (rust/contamination).<br>- Ku-Band failed self test. Antenna would not follow pointing commands. (Had to use alternate stow procedure.)<br>- GOX flow control valves 1 and 2 operated sluggish on first cycle.<br>- WCS fan separator 1 flooded exhibiting stall currents for 80 secs.<br>- STBD PLBD Forward R-T-L "A" Talkback failed to function.<br>- APU#3 chamber pressure low.<br>- Rt wing TPS damage.<br>- 4" LH <sub>2</sub> ET/Orbiter disconnect leak.<br>- Radar altimeter failed at 50 feet.<br>- Video cassette tapes jammed (4 tapes). |
| SEQ FLT #26  |  |  |  |  |   |   |                |   |              |   |   |
| KSC-26   |  |  |  |  |   |   |                |   |              |   |   |
| PAD<br>39B-2   | OMS PODS<br>LPO4 - 4<br>RPO3 - 8<br>FRC3 - 7 | PLT:<br>Richard O. Covey<br>(Flt 2 - STS 51-I)<br>P134/R73/V34/M67<br><br>M/S 1:<br>John M. Lounge<br>(Flt 2 - STS 51-I)<br>P135/R74/V35/M68<br><br>M/S 2:<br>George D. Nelson<br>(Flt 3 - STS 41-C &<br>STS 61-C)<br>P136/R37/V28/M36<br><br>M/S 3:<br>David C. Hilmers<br>(Flt 2 - STS 51-J)<br>P137/R77/V36/M71<br><br>MCC FCR-1 (11)<br>FLIGHT DIRECTORS:<br>Asc/Ent - G. E. Coen<br>O 1 - J. M. Hefflin<br>O 2 - C. W. Shaw<br>Ld/Plg - L.S.Bourgeois<br>MOD - T. W. Holloway<br>MDR - B. R. Stone<br>MDR - R. M. Kelso | WINDOW<br>DURATION:<br>3 HOURS (CREW<br>CONSTRAINT)<br><br>PLS - EDW<br>SLS - NOR<br>AOA - EDW<br>- NOR<br>TAL - BEN GUERIR<br>TAL WX - MORON<br>(SELECTED)<br>AUGMENTED CTG:<br>BANJUL<br><br>MAX Q = 707<br>M = 1.16<br><br>SRB SEP:<br>2:04.8 MET<br><br>MECO:<br>8:33.43 MET<br><br>ET SEP:<br>8:50.5 MET<br><br>OMS-1:<br>NONE<br><br>OMS-2:<br>39.55 MET<br>141.6 Seconds<br>222 FPS |  |   |   |                |   |              |   |   |
|        |  |  |  |  |   |   |                |   |              |   |   |
|      |  |  |  |  |   |   |                |   |              |   |   |
| S26-09-008 ---<br>Crew (No caption available) - see who you recognize from list above. |  |  |  |  |   |   |                |   |              |   |   |
|     |  |  |  |  |   |   |                |   |              |   |   |
| In MCC: G. Kranz, T. Holloway, A. Cohen, & unidentified.                               |  |    |  |  |   |   |                |   |              |   |   |



## Page 2-29 - STS-27

[illegible]

## Page 2-30 - STS-29

| FLT NO.          | ORBITER                             | CREW (5)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET  | ORBIT INC HA/HP | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|------------------|-------------------------------------|--|---|---|--|--|-----------------|--|---|---|
| STS-29 (STS-29R) | OV-103 (Flight 8) Discovery         | CDR: Michael L. Coats (Flt 2 - STS 41-DR) P143/R38/V39/M37   | KSC 39B 72:14:57:00Z 8:07:00 AM EST (P) 9:57:00 AM EST (A) Monday 7 3/13/89 (2)   | EDW 22 (EDW 21, CONC 7) 6:35:50 AM PST Saturday 6 3/18/89 (2) DEORBIT BURN: 77:13:35:15Z X RANGE: 384 NM ORB DIR: AL 5, ORBIT 79, REV 80 AIM PT: NOM MLGTD: 1195 FT 77:14:35:50Z VEL: 204 KGS 205 KEAS HDOT: -3 FPS TD NORM 195: 2085 FT NLGTD: 5027 FT 77:14:36:01Z VEL: 162 KGS HDOT: -1.9 FPS BRK INIT: 129 KGS AVE BRK DECEL: 8 FPS/S WHEELS STOP: 77:14:36:41Z 10534 FT WINDS: 4.4H, 4.1L KNOTS OFFICIAL: 6H, 1L DENS ALT: 1853 FT FLT DURATION: 4:23:38:50 119:38:50 S/T: 166:00:30:57 OV-103: 47:06:45:21 DISTANCE: 1,800,000 sm | 104/104 109% 100/104/ 66/104/ 65 1 = 2031 (1) 2 = 2022 (2) 3 = 2028 (2) M 3 EOM WEIGHT: 194940 X CG: 1093.7 LANDING: WEIGHT: 194790 X CG: 1095.3 | BI-031 RSRM 3 360L 003 ET-38 LWT- 29 ET RPT 240K 1:17:11 MET ET BR/UP 217K 1:17:50 MET ET IMPACT LAT: 13.20°N LONG: 162.65°W | 28.45° (18)     | DIRECT INSERTION POST OMS-2 162.59 X 160.27 NM TDRS-D DEPLOY 162.63 NM DEORBIT 178 X 164 NM VELOCITY 25787 FPS RANGE 4163 NM | OI-8B (3) CARGO: 47394 lbs PAYLOAD CHARGEABLE: 45316 lbs DEPLOYABLE: 37640 lbs NON-DEPLOYED: 6727 lbs MIDDECK: 949 lbs RETURNED: 9784 lbs SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 359715 lbs NON-DEPLOYED: 382229 lbs CARGO TOTAL: 840770 lbs PERFORMANCE MARGINS (LBS): FPR: 4698 FUEL BIAS: 968 FINAL TDDP: 3772 RECON: 2995 PAYLOADS: PLB: TDRS-D/IUS DEPLOYED SHARE OASIS-1 MIDDECK: IMAX PCG AMOS CHROMEX SSIP (2): SE 82-08 GAS: SE 82-08 CHIX 3 CRYO TK SETS NO RMS | KSC W/D: OPF 94, VAB 11, PAD 39 = 144 LAUNCH POSTPONEMENTS: - 3/11/89 launch postponed 1 day to 3/12/89 to replace MEC #2. - 3/12/89 launch postponed 1 day to 3/13/89 to replace FPOV actuator. 2-day total slip. LAUNCH SCRUBS: None. LAUNCH DELAYS: - 1H50M launch delay due to winds aloft and ground fog at KSC. TAL WX: - Ben Guerir (prime) selected - weather good throughout. ALTERNATE ASCENT I-LOADS: - LSEAT selected YAW negative which was uplinked (first uplink). FLIGHT DURATION CHANGES: None. FIRSTS: - First flight with corner alternate I-load capability. - First flight alternate ascent I-load uplinked. EVENTS: - TDRS-D/IUS deployed at 06:12:48 MET (rev 5). - SEP burn at 06:27:48 MET, 16.48 seconds, 31.1 FPS - OASIS-1 performed nominally. - DTO 0517 NWS Runway Evaluation. - DTO 0518 Revised System Braking Test. - Deorbit burn 162 seconds, 313.2 FPS. ET ENTRY (TUMBLE) CAST GLANCE: - Tumble rate 62 deg/sec prior to rupture, max DV - 552 FPS, number of pieces-30. |
| SEQ FLT #28      |                                     | PLT: John E. Blaha P144/R97/M88 M/S: James F. Buchli (Flt 3 - STS 51-C & STS 61-A) P145/R52/V24/M48 M/S: Robert C. Springer P146/R98/M89 M/S: James P. Bagian P147/R99/M90 | PLS - EDW AOA - NOR TAL - BEN GUERIR (Selected) TAL WX - MORON CLS - BANJUL LAUNCH WINDOW: 2.5 HOURS (CREW TIME ON BACK) MAX Q =710 M = 1.44 SRB SEP: 2:04.5 MET MECO: 8:30.8 MET ET SEP: 8:50 MET OMS-1: NONE OMS-2: 39:58 MET 141.4 Seconds 221.8 FPS |   |  |  |                 |  |   |   |
| KSC-28           |                                     |  |   |   |  |  |                 |  |   |   |
| PAD 39B-4        | OMS PODS LPO4 - 5 RPO3 - 9 FRC3 - 8 |  |   |   |  |  |                 |  |   |   |
|                  |                                     |   |   |   |  |  |                 |  |   |   |
|                  |                                     |    |   |   |  |  |                 |  |   |   |
|                  |                                     | <div>STS029-71-000AE---IUS/TDRS-D deployment from Discovery payload bay.</div>   |   |   |  |  |                 |  |   |   |
|                  |                                     | <div>Continued . . .</div>   |   |   |  |  |                 |  |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-31 - STS-29

| FLT NO.   | ORBITER | CREW (5)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------|----------------------------------|---|--|---|--------------------------|-----------------------|--|-----|---|--|
| STS-29<br>Continued   |         |                                  |   |    |   |                          |                       |  |     |   | Continued . . .<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- RCS jet R1U failed off at ET Sep.<br>- Excessive vapor at H <sub>2</sub> ET/Orbiter umbilical area prelaunch and tower clear.<br>- TAGS developer overtemp; however, best TAGS performance with more than 660 pages processed.<br>- Sluggish GOX FCV'S system 1 and 3.<br>- LH2 disconnect slow to close.<br>- FES shutdown during deorbit prep switch reconfiguration.<br>- Unable to dump ops 2 track 4.<br>- R OMS regulator "A" anomaly (OX & FU tank pressures approx 245 psi).<br>- SHARE operations had problems due to vapor bubbles in liquid channels.<br>- IMAX camera drive mechanism problem (belt jumped off track).<br>- CHROMEX not cooling properly.<br>- PLBD PORT B CLOSED indicator failed.<br>- TPS 132 debris hits, 23 greater than 1" |
| ABOVE: S89-28089 & KSC-89PC-26---OV-103,suspended by overhead crane hooked to support structure attached at four points, is lowered for mating to ET & SRBs at KSC VAB Bay 1. SSMEs are covered with protective red shields<br>BELOW: STS029-04-029---CDR Coats on OV-103's forward flight deck |         |                                  |   | BELOW: STS029-S-066--- Post Landing: Crew pose with NASA officials. Left to right: PLT Blaha, Bagian/MS, Rear Adm. Richard H. Truly/NASA Associate Administrator for Space Flight, Dr. James C. Fletcher/NASA Administrator, CDR Coats, Buchli/MS and Springer/MS. |   |                          |                       | s29-s-0041 -- Flight Directors Lee Briscoe and Ron Dittmore on console in MCC Flight Control Room. |     |   |  |
|   |         |                                  |   |    |   |                          |                       |               |     |   |  |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-32 - STS-30

| FLT NO.   | ORBITER                               | CREW (5)   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE                                       | SSME-TL NOM-ABORT EMERG                | SRB RSRM                       | ORBIT       |                               | FSW       | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS             | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------------------------------------|--|---|--|--|--------------------------------|-------------|-------------------------------|-----------|--|---|
| STS-30 (STS-30R)  | OV-104 (Flight 4) Atlantis            | CDR: David M. Walker (Flt 2 - STS 51-A) P148/R48/V40/M45   | KSC 39B 124:18:46:58.975Z 1:48:00 PM EDT (P) 2:46:59 PM EDT (A) Thursday 8 5/4/89 (1) | EDW 22, CONC (EDW 22, CONC 8) 12:43:26 PM PDT Monday 6 5/8/89 (2)      | 104/104 109%                           | BI-027                         | 28.871° (1) | STANDARD INSERTION            | OI-8B (4) | CARGO: 47783 lbs                                   | KSC W/D: OPF 79, VAB 11, PAD 43 = 133   |
| SEQ FLT #29   |                                       |  |   |  | 100/104/ 102/65/ 104/65                | RSRM 4 360L 004                |             | POST OMS-2 160.98 X 159.35 NM |           | CHARGEABLE: 45823 lbs                              | LAUNCH POSTPONEMENTS: None.   |
| KSC-29  |                                       | PLT: Ronald J. Grabe (Flt 2 - STS 51-J) P149/R76/V41/M70   |   | DEORBIT BURN: 128:18:40:49Z 165.7, DV 326                              | 1 = 2027 (2) 2 = 2030 (2) 3 = 2029 (2) | ET-39 LWT-22                   |             |                               |           | DEPLOYABLE: 40118 lbs                              | LAUNCH SCRUBS: 4/28/89 Launch scrubbed at T-31 seconds due to an SSME 1 LH2 recirc pump failure at T-55 seconds. Launch rescheduled for 5/4/89. 6-day total slip.   |
| PAD 39B-5   | OMS PODS LPO1 - 10 RPO1 - 10 FRC4 - 4 | M/S 1: Mark C. Lee R150/R100/M91   | WINDOW DURATION: 64 Minutes (TAL LIGHTING)  | XRANGE: 350 NM   |  | ET RPT 243K 46:50 MET          |             | MAGELLAN DEPLOY 161.84 NM     |           | NON-DEPLOYED: 5540 lbs                             | LAUNCH DELAYS: - 00H43M delay with hold at L-16 minutes due to RTLS ceiling violation. (1:48 PM EDT planned launch). Picked up at 2:15 PM EDT, counted down to T-5 minutes and held. Picked up count at 2:42 PM EDT when RTLS runway 15 was go (33 was no go due to broken ceiling and excessive tailwind). Total launch delay: 58M59S.   |
|   |                                       | M/S 2: Norman E. Thagard (Flt 3 - STS-7 & STS 51-B) P151/R20/V14/M19   | PLS - EDW AOA - EDW TAL - BEN GUERIR (SELECTED) TAL WX - MORON CTG - BANJUL RTLS 15   | MLGTD: 1314 FT 128:19:43:26Z VEL: 204 KGS 196 KEAS HDOT: -1.5 FPS      | M 3 EOM                                | ET BR/UP 212K 47:40 MET        |             | DEORBIT 176 X 160 NM          |           | MIDDECK: 165 lbs                                   | TAL WX: - Ben Guerir (prime) selected - Good weather at Ben Guerir and Moron.   |
|   |                                       | M/S 3: Mary L. Cleave (Flt 2 - STS 61-B) P152/R85/V42/F8   | MAX Q = 676 M = 1.07  | TD NORM 195: 1354 FT   | WEIGHT: 192558                         | ET IMPACT LAT: 28.85°S 86.89°E |             | VELOCITY 25788 FPS            |           | RETURNED: 7724 lbs                                 | I-LOADS: LSEAT selected nominal ascent I-loads - no uplink required.  |
|   |                                       | MCC FCR-1 (13)   | SRB SEP: 2:05.26 MET  | BRK INIT: 128 KGS  | X CG: 1097.4                           | T/V                            |             | RANGE 4147 NM                 |           | SHUTTLE ACCUMULATED WEIGHTS: 399833 lbs            | FLIGHT DURATION CHANGE: None.   |
|   |                                       | FLIGHT DIRECTORS: Asc - A. L. Briscoe O 1/E - R. D. Dittmore Ld/O 2 - J. M. Hefflin Plng - W. D. Reeves MOD - L. S. Bourgeois MDR - C. W. Shaw | MECO: 8:29.37 MET   | AVE BRK DECEL: 6.2 FPS/S   | WEIGHT: 192460                         |                                |             |                               |           | DEPLOYED: 387934 lbs                               | FIRSTS: - First interplanetary payload launch by Shuttle. First crosswind landing test.   |
|   |                                       |  | ET SEP: 8:46.67 MET   | WHEELS STOP: 128:19:44:30Z 11609 FEET                                  | X CG: 1099.1                           |                                |             |                               |           | NON-DEPLOYED: 387934 lbs                           | EVENTS: - Uplinked launch targeting command load ly and del Psi (inertial plane and first stage yaw steering). - Uplinked OMS targeting command load for OMS-1 and OMS-2.   |
| STS030-72-046 1989-05-08 --- First interplanetary payload -Magellan/IUS -launched by Shuttle. |                                       |  | OMS-1: 10:29 MET 141.72 Seconds 226.29 FPS  | ROLLOUT: 10295 FEET 64 SECONDS   |  |                                |             |                               |           | CARGO TOTAL: 888553 lbs                            | - IUS/Magellan deployed at 6:14:33 MET (rev 5). - Sep burn at 6:27:22 MET, 16 secs, 31.6 FPS.   |
|   |                                       |  | OMS-2: 44:27 MET 125.32 Seconds 197.03 FPS  | WINDS: VARIABLE 290/12G20 11 TO 19 KNOTS RIGHT XWIND OFFICIAL: 5H, 11R |  |                                |             |                               |           | PERFORMANCE MARGINS (LBS): FPR: 4698               | ET REENTRY (NO TUMBLE) - CAST GLANCE, poor quality, tumble rate not discernible.  |
|   |                                       |  |   | DENS ALT: 4900 FT  |  |                                |             |                               |           | FUEL BIAS: 968 FINAL TDDP: 4709 RECON: 2650        | SIGNIFICANT ANOMALIES: - SSME 1 LH2 Recirc pump failure. - GPC 4 quit (poll fail on SM CRT when GPC was taken to standby). IFM replaced GPC. - Cabin P Xducer test port left on during first launch attempt. - Excess water from galley H2O dispenser. - TAGS jam on 19th page. - Teleprinter character tops illegible. - Camera A spots on image. - ARRIFLEX 16MM camera operate lever failure (crew performed IFM). - Thruster R1U failed off at ET Sep. - R RCS OX Helium P A valve failed open. - FEA problems. - WONG dilemma. |
|   |                                       |  |   | FLT DURATION: 4:00:56:27 96:56:27                                      |  |                                |             |                               |           | PAYLOADS: PLB: MAGELLAN/IUS (VENUS PROBE) DEPLOYED |   |
|   |                                       |  |   | S/T: 170:01:27:24  |  |                                |             |                               |           | MID-DECK: AMOS FEA MLE                             |   |
|   |                                       |  |   | OV-104: 19:08:51:31  |  |                                |             |                               |           | CRYO TK SETS - 3                                   |   |
|   |                                       |  |   | DISTANCE: 1,477,500 sm   |  |                                |             |                               |           | NO RMS   |   |





STS030-21-013 --- Crew: Clockwise from upper right: CDR Walker, Cleave/MS, Lee/MS, Thagard/MS & PLT Grabe.



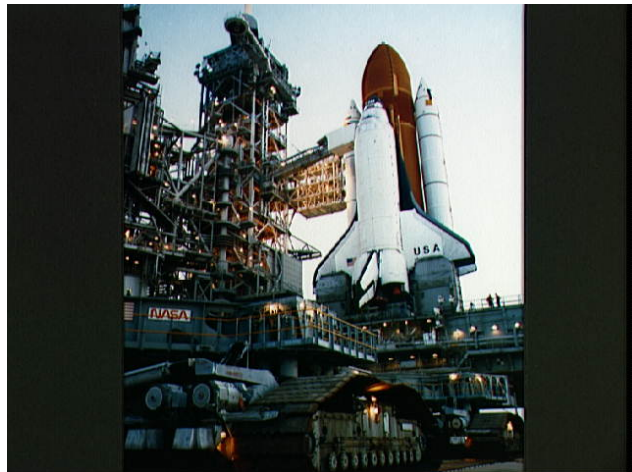
## Page 2-33 - STS-28

| FLT NO.             | ORBITER                                      | CREW (5)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES                                    | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br><br>AND<br>ET                                 | ORBIT      |  | FSW          | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---------------------|--|--|--|--|---|--|------------|--|--------------|---|---|
| STS-28<br>(STS-28R) | OV-102<br>(Flight 8)<br>Columbia             | CDR:<br>Brewster H. Shaw, Jr.<br>(Flt 3 - STS-9 &<br>STS 61-B)<br>P153/R25/V26/M24   | KSC 39B<br>220:12:37:00Z<br>8:37:00 AM EDT<br>Tuesday 5<br>8/8/89 (4)                    | EDW 17 LEFT<br>(EDW 23, LKBD 15)<br>6:37:09 AM PDT<br>Sunday 3<br>8/13/89 (2)  | 104/104<br>109%   | BI-028<br><br>RSRM 5<br>360L<br>005                          | 57°<br>(6) |  | OI-8B<br>(5) | DOD<br><br><u>PERFORMANCE MARGINS (LBS):</u><br>FPR: 4698<br>FUEL BIAS: 968<br>FINAL TDDP: 409<br>RECON: 158<br><br>3 CRYO TK SETS<br><br>AMOS<br>HEIN-LO<br>IOCM/APM<br>CLOUDS<br>CRUX<br>RME-III<br>LLL<br>SAM<br>VFT-2 | KSC W/D: OPF 190, VAB 11, PAD 25 = 227<br><br><u>LAUNCH POSTPONEMENTS:</u><br>- 8/7/89 launch postponed to 8/8/89 due to MPS He system. 1-day slip.<br><br><u>LAUNCH SCRUBS:</u> None.<br><br><u>LAUNCH DELAYS:</u><br>- Launch delay at T-9 due to an NSP frame sync error and MMU 1 read problem during G9 to OPS 101 transition.<br>- Launch delay due to KSC ground fog.<br><br><u>TAL WX:</u><br>- Zaragoza (prime) NO GO - thundershowers, Ben Guerir NO GO - crosswinds.<br>- Moron (selected) - GO throughout.<br><br><u>I-LOADS:</u><br>- LSEAT selected nominal ascent I-loads - no uplink required.<br><br><u>EVENTS:</u><br>- No blackout during entry, comm via TDRS-W.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Prelaunch problem, one of nose gear WOW proximity sensors began indicating weight on nose gear. Indication went away after insertion but returned later in flight causing a WOW dilemma during landing. NWS was enabled by crew by depressing SRB SEP pushbutton.<br>- MMU input/output error on OPS-1 transition.<br>- Pilot's seat moved aft during ascent.<br>- Vernier thruster F5R annunciated "fail leak."<br>- NLG WOW indication failed off.<br>- Forward RCS F5L thruster heater failed on.<br>- S-band PA2 power output degraded to 60 watts.<br>- Potable water dump valve failed open.<br>- Teleprinter cable shorted causing a 1.5-second short of 51A.<br>- Freon coolant loop 2 flow degraded about 100 lbs/hr & FCL 1 about 50 lb/hr.<br>- Radar altimeter 1 and 2 lost attitude reading at 26 feet.<br>- Hydraulic system 2 unloader valve operation out-of-spec.<br>- Body flap excessive deflection during ascent.<br>- NSP frame sync errors prelaunch.<br>- SSME 1 GHz flow control valve sluggish. |
| SEQ FLT #30         |  | PLT:<br>Richard N. Richards<br>P154/R101/M92   | LANDING SITE<br>PRIORITIES:<br>1. EDW LAKEBED<br>2. EDW CONC<br>3. NOR LAKEBED<br>4. KSC | <u>DEORBIT BURN:</u><br>225:12:36:57Z<br><br><u>XRANGE:</u> 186 NM<br><br><u>ORB DIR:</u> AL 7<br><br><u>AIM PT:</u> NOM | 100/104/<br>97/65/<br>104/65  | ET-31<br>LWT-24  |            |  |              |   |   |
| KSC-30              | OMS PODS<br>LP03 - 8<br>RPO4 - 4<br>FRC2 - 8 | M/S 1:<br>James C. Adamson<br>P155/R102/M93  | TAL: Zaragoza<br>TAL WX: Moron<br>(Selected)<br>CLS: Banjul                              | <u>MLGTD:</u> 5311 FT<br>225:13:37:09Z<br>VEL: 157 KGS<br>155 KEAS<br>HDOT: -1 FPS                                       | 1 = 2019 (5)<br>2 = 2022 (3)<br>3 = 2028 (3)                          | ET<br>BR/UP<br>220K<br>1:11:44<br>MET                        |            |  |              |   |   |
| PAD 39B-6           |  | M/S 2:<br>David C. Leestma<br>(Flt 2 - STS 41-G)<br>P156/R45/V43/M42   | RTLS: KSC 33<br>AOA: NOR   | <u>TD NORM 195:</u><br>2545 FT   | <u>M 3 EOM</u>  | <u>ET IMPACT LAT:</u><br>36.64°S<br><u>LONG:</u><br>149.65°W |            | <u>DEORBIT</u><br>166 X<br>160 NM<br><br><u>VELOCITY</u><br>25803 FPS<br><br><u>RANGE</u><br>4332 NM |              |   |   |
|                     |  | M/S 3:<br>Mark N. Brown<br>P157/R103/M94   | MAX Q = 679<br>M = 1.12<br>00:59.3 MET   | <u>NLGTD:</u> 7393 FT<br>225:13:37:14Z<br>VEL:125 KGS<br>HDOT: -9.5 FPS  | <u>WEIGHT:</u><br>200214<br>X CG: 1089.4                              |  |            |  |              |   |   |
|                     |  | MCC FCR-2 (17)   | <u>SRB SEP:</u><br>2:04 MET  | <u>BRK INIT:</u> 79 KGS  |   |  |            |  |              |   |   |
|                     |  | FLIGHT DIRECTORS:<br>Asc/Ent-R. D. Dittmore<br>O 1 - G. A. Pennington<br>Ld/O 2 - C. R. Knarr<br>Plng - N. W. Hale<br>MOD - T. W. Holloway | <u>MECO:</u><br>8:15 MET   | <u>Ave BRK DECEL:</u><br>6.3 FPS/S   |   |  |            |  |              |   |   |
|                     |  |  | <u>ET SEP:</u><br>8:53 MET   | <u>WHEELS STOP:</u><br>225:13:37:52Z<br>11326 FEET   |   |  |            |  |              |   |   |
|                     |  |  | OMS-1:<br>NONE   | <u>ROLLOUT:</u><br>6015 FEET<br>46 SECONDS   |   |  |            |  |              |   |   |
|                     |  |  | OMS-2:<br>37:52:23 MET<br>106 Seconds  | <u>WINDS:</u><br>160° @ 6 KTS<br>5.8H, 1.6 L KTS<br>OFFICIAL: 1H, 6L   |   |  |            |  |              |   |   |
|                     |  |  |  | <u>DENS ALT:</u> 3670 FT   |   |  |            |  |              |   |   |
|                     |  |  |  | <u>FLT DURATION:</u><br>5:01:00:09<br>121:00:09  |   |  |            |  |              |   |   |
|                     |  |  |  | <u>S/T:</u> 175:02:27:33   |   |  |            |  |              |   |   |
|                     |  |  |  | <u>OV-102:</u><br>46:02:54:20  |   |  |            |  |              |   |   |
|                     |  |  |  | <u>DISTANCE:</u><br>2,070,943 sm   |   |  |            |  |              |   |   |





STS-28 crew portrait on middeck: Clockwise starting with Adamson/MS (mustache) are Leestma/MS, Brown/MS, PLT Richards, and CDR Shaw. In center is tail end of stuffed toy animal.



S89-41096,1989-08-09--- STS-28 Columbia, OV-102, is left at KSC LC Pad 39B by crawler transporter. Crawler transporter pulls out from under mobile launcher platform. View provided by KSC with alternate number KSC-89PC-684.

## Page 2-34 - STS-34



[illegible]



## Page 2-35 - STS-33

[illegible]

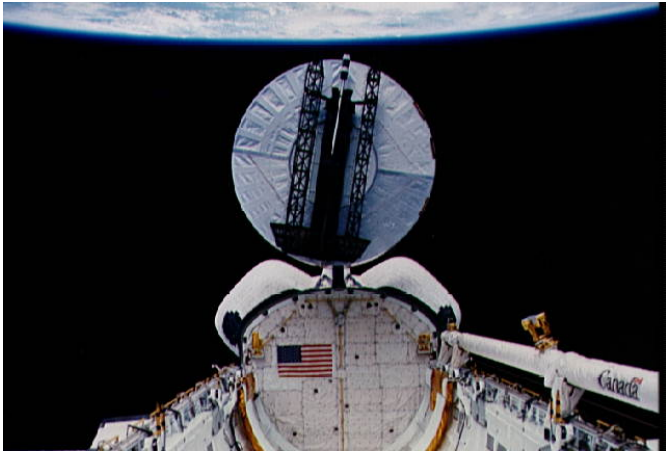



## Page 2-36 - STS-32

| FLT NO.  | ORBITER                                      | CREW (5)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES                                     | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET  | ORBIT         |  | FSW          | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|--|--|--|---|--|---|---------------|--|--------------|---|---|
|  |  |  |  |   |  |   | INC           | HA/HP  |              |   |   |
| STS-32<br>(STS-32R)  | OV-102<br>(Flight 9)<br>Columbia             | CDR:<br>Daniel C. Brandenstein<br>(Flt 3 - STS-8<br>& STS 51-G)<br>P168/R21/V16/M20  | KSC 39A<br><br>09:12:35:00Z<br>7:35:00 AM EST (P)<br>7:35:00 AM EST (A)<br>Tuesday 6<br>1/9/90 (4) | EDW 22, CONC<br>(EDW 26, CONC 10)<br>20:09:35:36.2Z<br><br>1:35:36 AM PST<br>Saturday 7<br>1/20/90 (3)<br><br>DEORBIT BURN:<br>20:08:30:22Z<br>299.5 Seconds<br>DV 489.7 FPS<br><br>XRANGE:372 NM<br><br>ORB DIR: AL10<br>AIM PT: NOM<br><br>MLGTD: 1804 FT<br>20:09:35:36.2Z<br>VEL: 209 KGS<br>207 KEAS<br>HDOT: -1 FPS<br><br>TD NORM 195:<br>3100 FT<br><br>NLGTD: 6676 FT<br>20:09:35:51.5Z<br>VEL:160 KGS<br>HDOT: -2.7 FPS<br><br>BRK INIT: 141 KGS<br><br>AVE BRK DECEL:<br>6.3 FPS/S<br><br>WHEELS STOP:<br>20:09:35:39.3Z<br>12495 FEET<br><br>ROLLOUT:<br>10731 FEET<br>64 SECONDS<br><br>WINDS:<br>1.9H, 3.5R KTS<br>OFFICIAL: 1H, 4R<br><br>DENS. ALT: 923 FT<br><br>FLT DURATION:<br>10:21:00:36<br>261:00:36<br><br>S/T: 195:23:14:18<br><br>OV-102:<br>56:23:54:56<br><br>DISTANCE:<br>4,509,972 Sm | 104/104<br>109%<br><br>100/104/<br>102/65/<br>104/65<br><br>1 = 2024 (1)<br>2 = 2022 (4)<br>3 = 2028 (4)<br><br>M 3 EOM<br><br>WEIGHT:<br>228523<br><br>X CG: 1078.2<br><br>LANDING<br><br>WEIGHT:<br>228335<br><br>X CG: 1079.6 | BI-035<br><br>RSRM 8<br><br>ET-32<br>LWT-25<br><br>ET<br>BR/UP<br>189K<br>1:19:35<br>MET<br><br>T/V<br>OFF<br><br>ET<br>IMPACT<br>LAT:<br>10.44°N<br>LONG:<br>157.2°W | 28.5°<br>(20) | DIRECT<br>INSERTION<br><br>POST<br>OMS-2<br>193.48 X<br>155.76 NM<br><br>SYNCOM<br>DEPLOY<br>169.09 NM<br><br>LDEF<br>RETRIEVE<br>178.3NM<br><br>DEORBIT<br>178 X<br>173 NM<br><br>VELOCITY<br>25823 FPS<br><br>RANGE<br>4317 NM | OI-8C<br>(2) | CARGO:<br>26458 lbs<br><br>PAYLOAD<br>CHARGEABLE:<br>18317 lbs<br><br>DEPLOYABLE:<br>15316 lbs<br><br>NON-DEPLOYED:<br>1962 lbs<br><br>MIDDECK:<br>1039 lbs<br><br>RETRIEVED (LDEF)<br>21393 lbs<br><br>RETURNED:<br>32565 lbs<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>453472 lbs<br>NON-DEPLOYED:<br>398517 lbs<br>CARGO TOTAL:<br>963624 lbs<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4698<br>FUEL BIAS: 968<br>FINAL TDDP: 1956<br>RECON: 992<br><br>PAYLOADS:<br>PLB:<br>LONG DURATION<br>EXPOSURE<br>FACILITY (LDEF)<br>RETRIEVAL<br>AND RETURN<br><br>SYNCOM IV-5<br>(DEPLOYED)<br><br>MIDDECK<br>IOCM<br>IMAX<br>CNCR, PCG (2)<br>FEA, AFE, MLE<br>L3 (LLL)<br>AMOS<br>ACIP<br>AADS<br><br>5 CRYO TK SETS<br><br>RMS 20 (S.N. 201)<br>Used for LDEF<br>capture and berth,<br>and PKM burn<br>monitor | KSC W/D: OPF 86, VAB 10, PAD 33 = 129<br><br>LAUNCH POSTPONEMENTS:<br>- 12/18/89 launch postponed 21 days to 1/8/90 due to delays in readiness of pad 39A after pad modification, holidays, and Orbiter aft PCA R&R.<br><br>LAUNCH SCRUBS:<br>- 1/8/90 launch scrubbed after holding at T-9 minutes, then counting down to T-5 minutes and holding until launch window expired when RTLS weather did not improve (low ceiling/fog). Rescheduled launch for 1/9/90.<br>- 22-day total slip.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX:<br>- Ben Guerir 36 (prime) - selected - good weather.<br><br>I-LOADS:<br>- LSEAT selected yaw positive I-Load - alternate I-Load uplink 2.<br><br>LAUNCH TARGETING COMMAND LOAD:<br>- Uplinked load for inertial plane of LDEF.<br><br>FLIGHT DURATION CHANGE:<br>- Extended 1 day due to fog at PLS (EDW) and unacceptable weather at NOR and KSC.<br>- Plus One rev to reload BFS into extended GPC2.<br><br>NIGHT LANDING: Third Shuttle night landing.<br><br>FIRSTS:<br>- First flight from pad 39A since STS 61-A.<br><br>EVENTS:<br>- SYNCOM-IV-F5 deployed at 1:00:43:39 MET (rev 17).<br>- Rendezvous with Long Duration Exposure Facility (LDEF) as planned, with grapple at 3:02:41:05 MET (rev 50). LDEF was deployed on STS 41-C.<br>- No blackout during entry, comm via TDRS-W.<br>- Deorbit burn O-O-P component of 51° with longest OMS burn time of 299.5 seconds.<br><br>RENDEZVOUS 8:<br>With LDEF for capture and return.<br><br>Continued . . . |
| SEQ FLT #33  |  |  |  |   |  |   |               |  |              |   |   |
| KSC-33   |  |  |  |   |  |   |               |  |              |   |   |
| PAD<br>39A-25  | OMS PODS<br>LP03 - 9<br>RPO4 - 5<br>FRC2 - 9 | PLT:<br>James D. Wetherbee<br>P169/R108/M97<br><br>M/S 1:<br>Bonnie J. Dunbar<br>(Flt 2 - STS 61-A)<br>P170/R79/V49/F7<br><br>M/S 2:<br>Marsha S. Ivins<br>P171/R109/F12<br><br>M/S 3:<br>G. David Low<br>P172/R110/M98<br><br>MCC FCR-1 (15)<br><br>FLIGHT DIRECTORS:<br>Asc/Ent - A. L. Briscoe<br>L/O1 - G. A. Pennington<br>O 2 - W. D. Reeves<br>Plng - R. E. Castle<br>MOD - B. R. Stone |  |   |  |   |               |  |              |   |   |
| MPL-3  |  |  |  |   |  |   |               |  |              |   |   |
|    |  |  |  |   |  |   |               |  |              |   |   |
|   |  |  |  |   |  |   |               |  |              |   |   |
| <p>STS032-57-006    1990-01-20 STS-32<br/>Crew portrait with a SNOOPY stuffed toy:<br/>CDR Brandenstein (right, rear), PLT<br/>Wetherbee (left, rear), &amp; front row (l to r)<br/>MS/Ivins, MS/Dunbar, and MS/Low during<br/>a record setting 11-day stay in Earth-orbit</p> |  |  |  |   |  |   |               |  |              |   |   |
| <p>STS-32 Liftoff (Wikipedia, the free encyclopedia) --- First flight from pad 39A since STS 61-A on 10/30/85.</p>   |  |  |  |   |  |   |               |  |              |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-37 - STS-32

| FLT NO.                 | ORBITER | CREW (5)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS                | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|-------------------------|---------|----------------------------------|---|--|--|-----------------|-----------------|--|-----|---|--|
| STS-32<br><br>Continued |         |                                  |   |   |  |                 |                 |  |     |   | <p>Continued . . .</p> <p><u>SIGNIFICANT ANOMALIES:</u></p> <ul style="list-style-type: none"> <li>- GPC 5 (BFS) registered illegal engage input/output term B during final entry checks. BFS was loaded into GPC2, GPC set restrung and GPC5 powered off. (Landing was delayed one revolution.)</li> <li>- FM transmitter failed.</li> <li>- APU 3 lubrication oil outlet pressure high (90 psi)</li> <li>- TAGS paper jammed.</li> <li>- GO<sub>2</sub> FCV 2 open cycle sluggish.</li> <li>- Humidity separator water bypass anomalies (free water from SEP B and SEP A).</li> <li>- Waste water dump line blockage at 18:13:29:00Z, no dumps performed subsequently.</li> <li>- FES topping duct B string heater failure.</li> <li>- IMU 1 RM failed (transient 4-axis accel-bias.</li> <li>- Hydraulic systems 1 and 2 circ pump unloader valves excessive leakage.</li> <li>- BFS GPC errors.</li> <li>- At 17:23:46:51Z during sleep period, a bad state vector was uplinked just prior to LOS, Orbiter rotated 3°/sec.</li> <li>- WSB sys 2 and 3 excessive regulator pressure decay.</li> <li>- RMS was used to conduct external survey (TPS).</li> <li>- Multiple S-Band dropouts.</li> <li>- Smoke detector 3A transient alarm.</li> <li>- WBS 3 controller A over controlling.</li> <li>- Ku-band antenna feed heater erratic.</li> <li>- MPS LH<sub>2</sub> F&amp;D (outboard) relief valve leak.</li> <li>- Pilot seat would not drive down.</li> <li>- CCTV camera problems.</li> <li>- Heaviest landing at 228,335 lbs.</li> </ul> |
|                         |         |                                  |   |  |  |                 |                 |  |     |   | <p>STS032-85-051, 1990-01-20---LDEF Retrieval over South America. LDEF proposed by NASA LRC was deployed by STS-41C on 04/13/1984.</p>   |
|                         |         |                                  |   |  |  |                 |                 |  |     |   | <p>STS032-15-022 STS032-15-022 STS-32 Commander Brandenstein celebrates birthday on OV-102's aft flight deck.</p>  |
|                         |         |                                  |   |  |  |                 |                 |  |     |  | <p>S89-48717 1989-11-07 STS-32 Flight Directors in MCC standing in front of the flight director's consoles are (l. to r.) Alan L. Briscoe, Granvil A. Pennington, and Robert E. Castle, Jr.</p>  |

## Page 2-38 - STS-36

[illegible]



## Page 2-39 - STS-31

[illegible]

## Page 2-40 - STS-41

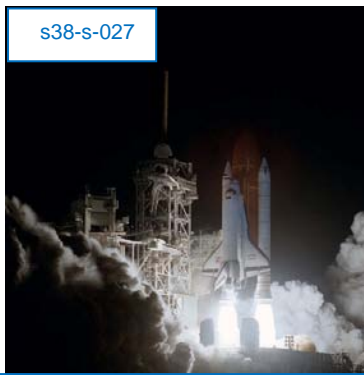
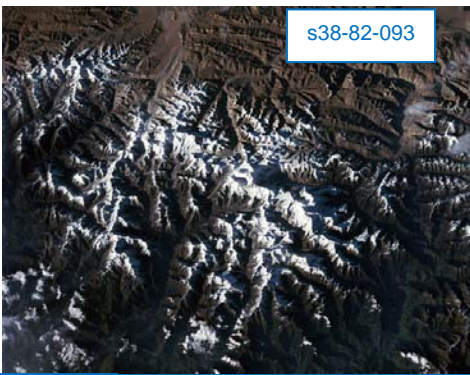
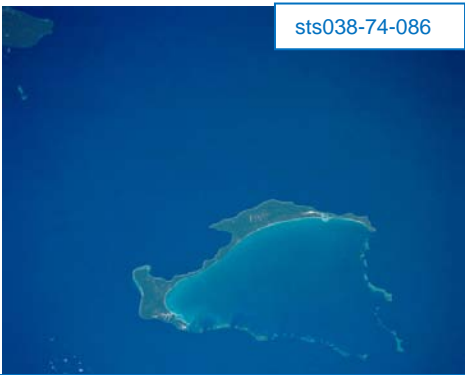


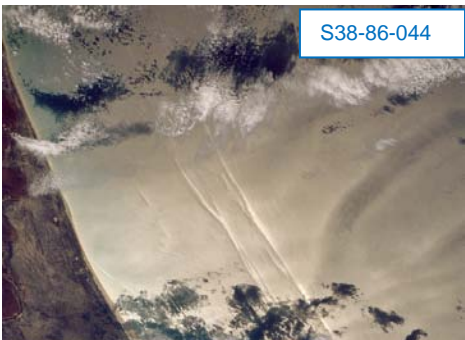

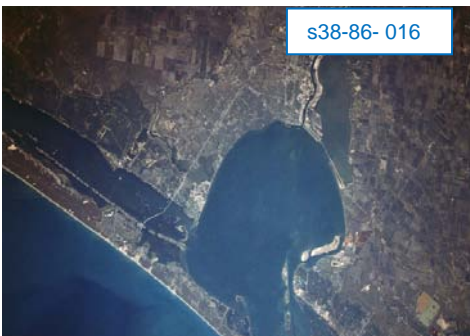

[illegible]

## Page 2-41 - STS-38

[illegible]



## SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (5)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET   | ORBIT<br><br>INC<br><br>HA/HP |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|--|---|--|---|--|-------------------------------|--|-----|--|--|
| STS-38  |         |  |   |  |   |  |                               |  |     |  | Continued . . .  |
| Continued   |         |  |   |  |   |  |                               |  |     |  |  |
| STS-38: LAUNCH ----- A VARIETY OF EARTH VIEWS ----- LANDING<br>(Captions Not Available)                     |         |  |   |  |   |  |                               |  |     |  |  |
| <div>s38-s-027</div>        |         | <div>s38-82-093</div>     |   |  |   | <div>sts038-74-086</div>  |                               | <div>FIRSTS:</div> <ul style="list-style-type: none"><li>- First flight with Air Force, Navy, Army, and Marine Corps crewmembers. All 4 hymns were used as wakeup music on one day.</li><li>- First flight of GOX FCV's in step 2 position.</li></ul> <div>SIGNIFICANT ANOMALIES:</div> <ul style="list-style-type: none"><li>- WSB 2 not cooling on controller A.</li><li>- FES water supply accumulator heater biased low.</li><li>- Vacuum cleaner short, CB 29 opened.</li><li>- CCTV monitor 2 fault light on - powered down.</li><li>- APU 2 EGT and APU 2 and 3 injector tube temps interacting.</li><li>- Right vent door 1 and 2 purge position dropped to closed position instead of purge position</li><li>- RIU PC low.</li><li>- Continuous 'Tire 'Press' FDA messages post landing.</li><li>- Several smoke detectors had event indicators go high but not high enough to trigger alarm.</li><li>- GPC mode switch found in STDBY and power switch in off.</li></ul> |     |  |  |
| <div>sts038-92-077</div>   |         | <div>s38-78-090</div>    |   |  |   | <div>S38-86-044</div>    |                               |  |     |  |  |
| <div>sts038-86-104</div>  |         | <div>s38-86- 016</div>  |   |  |   | <div>s38-s041</div>     |                               |  |     |  |  |

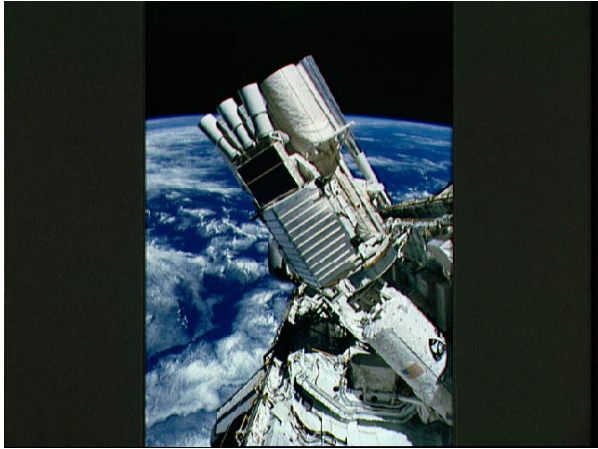
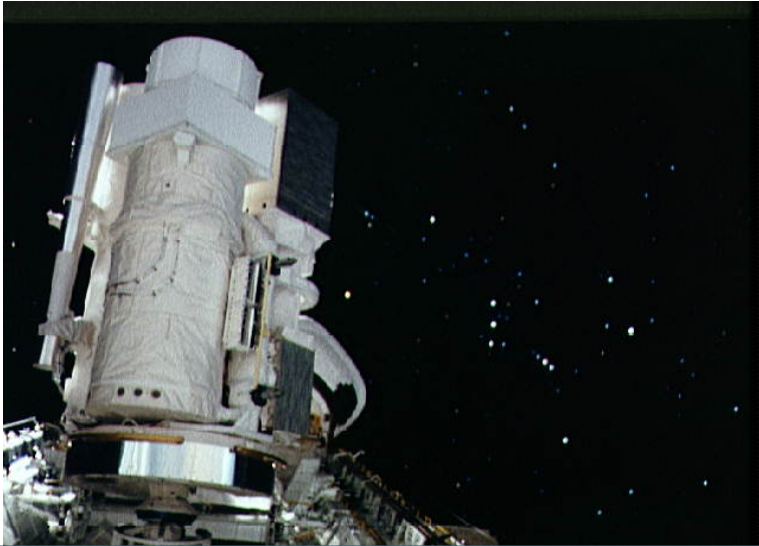



## Page 2-43 - STS-35

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-44 - STS-35

| FLT NO.  | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET  | ORBIT<br>INC HA/HP |  | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|---------|----------------------------------|--|--|--|--|--------------------|--|---|--|--|
| STS-35   |         |                                  |  |  |  |  |                    |  |   |  | Continued ...  |
| Continued  |         |                                  |  |  |  |  |                    |  |   |  | <p><u>LAUNCH DELAYS:</u></p> <ul style="list-style-type: none"> <li>- 21MTS delay while Range Safety had helicopter verify 8000 foot minimum optical coverage.</li> </ul> <p><u>TAL WX:</u></p> <ul style="list-style-type: none"> <li>- Weather good at Banjul and Ben Guerir.</li> </ul> <p><u>I-LOADS:</u></p> <ul style="list-style-type: none"> <li>- Launch delayed to new season and pitch negative became pitch nominal which LSEAT selected and was uplinked (uplink 5).</li> </ul> <p><u>NIGHT LAUNCH:</u> Space Shuttle #6.</p> <p><u>NIGHT LANDING:</u> Space Shuttle #4.</p> <p><u>EVENTS:</u></p> <ul style="list-style-type: none"> <li>- Most people in Earth orbit at the same time - 12 (7 Americans and 5 Soviets).</li> </ul> <p><u>SIGNIFICANT ANOMALIES:</u></p> <ul style="list-style-type: none"> <li>- FCL-1 degraded flowrate noticed before first launch attempt. Did not affect mission and performed as predicted.</li> <li>- S/L DDS 1 (DDU) failed on FD1. Crew smelled smoke.</li> <li>- S/L DDS 2 failed after 4 days. Crew smelled smoke. (Crew did IPS pointing and ground sent commands to operate experiments.)</li> <li>- S/L subsystem computer failed due to a command problem caused by error in workstation program, recovered by IPL.</li> <li>- Degraded waste water flow, virtual blockage at 152 hours. Filled CWC with 92 lbs, wastewater transferred to 15 female UCD's and 18 male UCD's.</li> <li>- TAGS jam, TAGS tool broke.</li> <li>- OPS 1 track 2 and OPS 2 track 5 problems.</li> <li>- P/L recorder poor data quality.</li> <li>- HDRR failed after 2 days of operations.</li> <li>- Cameras B, C, &amp; D problems.</li> <li>- Several software patches were required to correct experiment/IPS target tracking.</li> <li>- S-band UL and LR antenna problems.</li> <li>- Several payload experiment problems.</li> <li>- WSGT control computer failure.</li> <li>- APU 2 lube oil pressure high during ascent &amp; entry (wax formation caused by hydrazine contamination).</li> <li>- No blackout during entry.</li> </ul> |
|    |         |                                  |    |  |  |  |                    |  |   |  |  |
| s35-13-008 -- Wisconsin Ultraviolet photo-Polarrimeter Experiment (WUPPE) on Spacelab pallet. The Broad Band X-Ray Telescope (BBXRT) is behind this pallet and is not visible. |         |                                  | STS035-28-022 1990-12-10 Astronomy Laboratory 1 (ASTRO-1) telescopes in the PL/Bay. At right is the Orion nebula. The three ultraviolet telescopes are mounted and coaligned on a common structure and attached to the Instrument Pointing System (IPS).                             |  |  |  |                    |  |   |  |  |
|    |         |                                  |   |  |  |  |                    |  |   |  |  |
| S88-54116 1988-11-30 Official insignia for the Johnson Space Center's (JSC's) Amateur Radio Club   |         |                                  | S90-32048 1990-03-16 Shuttle Amateur Radio Experiment (SAREX) equipment held by R. Parise/PS at the JSC Full Fuselage Trainer. SAREX is used to conduct shortwave radio transmissions between ground amateur radio operators and a licensed onboard operator (in this case, Parise). |  |  |  |                    |  | STS035-05-036 1990-12-11 STS-35 Commander Brand talks to family using SAREX on Columbia's middeck |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER  | CREW (5)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET   | ORBIT<br>INC<br>HA/HP |   | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|--|---|---|--|---|--|-----------------------|---|--------------|---|--|
| STS-37<br>SEQ FLT #39<br>KSC-39<br>PAD 39B-12<br>MLP-1 | OV-104<br>(Flight 8)<br>Atlantis<br><br>OMS PODS<br>LPO1 - 14<br>RPO1 - 14<br>FRC4 - 8 | CDR:<br>Steven R. Nagel<br>(Flt 3 - STS 51-G<br>& STS 61-A)<br>P200/R64/V23/M59<br><br>PLT:<br>Kenneth D. Cameron<br>P201/R121/M109<br><br>M/S 1:<br>Linda M. Godwin<br>P202/R122/F13<br><br>M/S 2:<br>Jerry L. Ross<br>(Flt 3 - STS 61-B & STS-27)<br>P203/R86/V38/M78<br><br>M/S 3:<br>Jay Apt<br>P204/R123/M110<br><br>EMU/TETHERED EVA:*<br>EV1 - Jerry Ross<br>EV2 - Jay Apt<br><br>EVA 1 - 4/7/91<br>SS EVA #14<br>3:40/4:32<br>SS UNSCHED EVA #2<br>RELEASE STUCK GRO<br>HI GAIN ANTENNA<br><br>EVA 2 - 4/8/91<br>SS EVA #15<br>5:47/5:57<br>DEMO SPACE STATION<br>(CREW & EQUIPMENT<br>TRANSLATION AID) | KSC 39B<br>95:14:22:44.98Z<br>9:18:00 AM EST (P)<br>9:22:45 AM EST (A)<br>Friday 6<br>4/5/91 (7)<br><br>LAUNCH WINDOW:<br>2H30M (CTOB)<br><br>PLS: EDW LKBD<br>TAL: BANJUL<br>TAL ALT: BEN<br><br>SELECTED:<br>RTLS: KSC 33<br>TAL: BEN 36<br>AOA: EDW 22<br><br>TDEL:<br>-0.16<br>-0.118<br><br>MAX Q:<br>676<br>681<br><br>SRB STG:<br>2:04.8<br><br>PERF: NOM<br><br>2 ENG TAL (BEN)<br>2:59<br>2:58<br><br>NEG RETURN:<br>4:04<br>4:07<br><br>PTA:<br>4:46<br>4:42<br><br>PTM:<br>5:51<br>5:45<br><br>MECO CMD:<br>8:34<br>8:33.3<br><br>VI:<br>26010<br>26005<br><br>OMS-2:<br>Tig =<br>DV=369 FPS | EDW 33, LAKEBED<br>(EDW 31, LKBD 18)<br><br>5:55:29 AM PST<br>Thursday 2<br>4/11/91 (6)<br><br>XRRANGE: 375 NM<br><br>ORB DIR: AL 11<br><br>AIM PT: CLOSEIN<br><br>MLGTD: -623 FT<br>101:13:55:29Z<br>VEL: 156 KGS<br>168 KEAS<br>HDOT: -2 FPS<br><br>TD NORM 195:<br>-2384 FT<br><br>NLGTD: 1200 FT<br>101:13:55:35Z<br>VEL:130 KGS<br>HDOT: -8.4 FPS<br><br>BRK INIT: 93 KGS<br><br>AVE BRK DECEL:<br>4.8 FPS/S<br><br>WHEELS STOP:<br>101:13:56:25Z<br>5741 FT<br><br>ROLLOUT:<br>6364 FEET<br>56 SECS<br><br>WINDS:<br>14.1H, 9.6 R KTS<br>OFFICIAL: 15H, 8R<br><br>DENS. ALT: 1732 FT<br><br>FLT DURATION:<br>5:23:32:44<br>143:32:44<br><br>S/T: 229:09:31:09<br><br>OV-104:<br>39:16:16:24<br><br>DISTANCE:<br>2,487,075 sm | 104/104/<br>109%<br><br>ACTUAL:<br>100/104/<br>87/67/<br>104/65<br><br>1 = 2019 (8)<br>2 = 2031 (5)<br>3 = 2107 (4)<br><br>M 3 EOM<br><br>WEIGHT:<br>190266<br><br>X CG: 1087.4<br><br>LANDING<br><br>WEIGHT:<br>190098<br><br>X CG: 1089.2 | BI-042<br><br>RSRM<br>14<br><br>ET-37<br>LWT-30<br><br>ET<br>RPT<br>237K<br>1:22:20<br>MET<br><br>ET<br>BR/UP<br>195K<br>1:23:25<br>MET<br><br>ET<br>IMPACT<br>LAT:<br>20.23°N<br>LONG:<br>149.3°W | 28.453°<br>(25)       | DIRECT<br>INSERTION<br><br>INSERTION<br>ALTITUDE:<br>244.2 X<br>241.2 NM<br><br>GRO DEPLOY<br>HO = 246.6<br>NM<br><br>DEORBIT<br><br>VELOCITY<br>24612 FPS<br><br>ENTRY<br>RANGE<br>4175 NM | OI-8F<br>(1) | CARGO:<br>40561 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>36800 LBS<br><br>NON-DEPLOYED:<br>1615 LBS<br><br>DEPLOYABLE:<br>34442 LBS<br><br>MIDDECK:<br>743 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>549613 LBS<br>NON-DEPLOYED:<br>437816 LBS<br>CARGO TOTAL:<br>1115834 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4652<br>FUEL BIAS: 994<br>FINAL TDDP:1116<br>RECON: 525<br><br>PAYLOADS:<br>PLB:<br>GAMMA RAY<br>OBSERVATORY<br>(GRO) DEPLOYED<br>APM<br>CETA<br><br>MIDDECK:<br>PCG, BLOCK II<br>RME-III<br>SAREX<br>AMOS<br>BIMDA<br><br>3 CRYO TK SETS<br><br>RMS 23 (S.N. 303<br>USED FOR<br>GRO DEPLOY) | KSC W/D: OPF 97, VAB 6, PAD 22 = 125 days<br><br>LAUNCH POSTPONEMENT:<br>- On 8/2/90, launch date was 3/27/91.<br>- 4-day postponement prior to 10/90 (launch 4/1/91).<br>- 7-day postponement in 11/90, STS-38 launch delay, launch date 4/8/91 (under review).<br>- On 2/28/91, decision made to rollback STS-39 from pad to repair ET door hinge cracks. OV-104 ET doors repaired before OPF rollout. OV-103 rollback caused STS-39 to be launched after STS-37.<br>- At LSFR, launch date 4/4/91 (under review).<br>- Postponed 1 day to 4/5/91 (tile and FRT).<br>- 9-day total slip from 8/90.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS:<br>- 4M45S delay due to violation of RSO 8000-foot ceiling requirement at T-9 and range "B LAST" prediction (Counted to T-5 and held for waiver.)<br><br>TAL WX:<br>- Banjul no go because of tail winds (brake energy).<br>- Ben Guerir 36 go (selected).<br><br>RTLS:<br>- Forecast NO GO RW & ceiling, observed NO GO at T-22 mins. Selected KSC NOM 33.<br><br>I-LOADS:<br>- LSEAT select nominal I-loads, no uplink required.<br><br>FLIGHT DURATION CHANGES:<br>- EDW 15 was first priority. Waved off one rev then extended flight 1 day due to winds/turbulence.<br>- Extended one rev due to winds at EDW. Extension total, 1 day + 1 rev.<br><br>GRO DEPLOY: 2:08:14:02 MET<br>Unscheduled EVA to release GRO antenna.<br><br>FIRSTS:<br>- First flight of new GPC's (AP-101S).<br>- First flight of OI-8F.<br>- First EVA since STS 61-B on 12/01/85.<br><br>Continued ... |




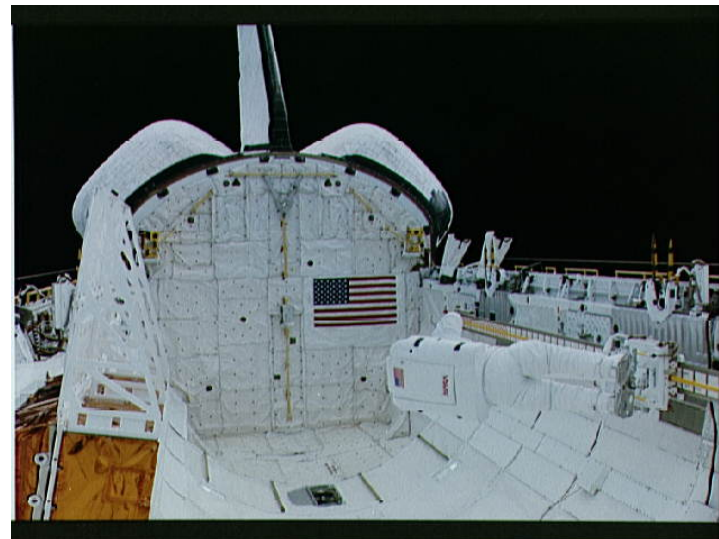
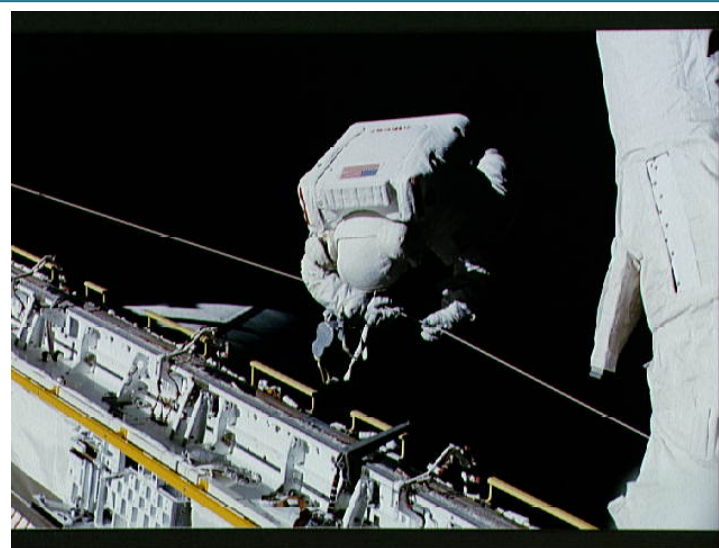
STS037-30-024 1991-04-11 STS-37  
Crew on Atlantis' middeck: Back row: CDR Nagel and PLT Cameron. Front row, left to right: Ross/MS, Godwin/MS, and Apt/MS. Cards refer to astronauts' "ACE Moving Company".





Continued...

\* TWO EVA TIMES ARE PROVIDED: (1) OLD DEFINITION - STARTED WHEN EMU WENT TO BAT POWER AND ENDED WHEN SWITCHED TO ORBITER POWER  
(2) NEW DEFINITION - STARTS WHEN EMU GOES TO BAT POWER AND ENDS WHEN AIRLOCK REPRESS STARTS

# SPACE SHUTTLE MISSIONS SUMMARY




| FLT NO.   | ORBITER | CREW (7)  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE | SSME-TL NOM-ABORT EMERG | SRB RSRM AND ET | ORBIT |       | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---------|---|--|----------------------------------|-------------------------|-----------------|-------|-------|-----|--|--|
|   |         | TITLE, NAMES & EVA'S  |  |                                  |                         |                 | INC   | HA/HP |     |  |  |
| STS-37  |         | Continued...<br><br>MCC FCR-1 (19)<br><br><u>FLIGHT DIRECTORS:</u><br>Asc/Ent - N. W. Hale<br>Ld/O 1 - C. W. Shaw<br>O 2 - J. M. Hefflin<br>Plng - P. L. Engelauf<br>MOD - G. E. Coen |  |                                  |                         |                 |       |       |     |  | Continued ...<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Thruster R1U failed off 32 seconds after MECO.<br>- WSB 2A temporary spray bar freeze up during ascent.<br>- WSB 2A and 3A lube oil overcooling during entry.<br>- PRSD O <sub>2</sub> manifold valve failed to close.<br>- EVA glove palm bar penetrated restraint and glove bladder.<br>- Prelaunch BFS navigation anomaly.<br>- Ku-band antenna erratic in ant mode.<br>- EMU-1 failed to charge battery post EVA-1.<br>- Abnormal O <sub>2</sub> concentration in aft compartment (220 PPM)<br>- Unscheduled EVA required to deploy GRO high gain antenna.<br>- Scheduled EVA. |
|   |         |   |    |                                  |                         |                 |       |       |     |  |  |
| STS037-99-089 1991-04-11 Deployed Gamma Ray Observatory (GRO) over Baja California, Mexico (31.5N, 113.0W), the Salton Sea and Imperial Valley region of California where the mouth of the Colorado River empties into the Sea of Cortez are clearly visible. |         |   | TOP: STS037-52-013 1991-04-11 Apt/MS, suited in Extravehicular Mobility Unit (EMU), tests Crew and Equipment Translation Aid (CETA) electrical hand pedal cart during EVA in P/L Bay). |                                  |                         |                 |       |       |     |  |  |
|    |         |   |  |                                  |                         |                 |       |       |     |  |  |
| At Right: STS037-55-012 1991-04-11 Ross/MS drifts outside P/L Bay as he attaches a tether to a port side guidewire during EVA.  |         |   |  |                                  |                         |                 |       |       |     |  |  |

## Page 2-47 - STS-39

| FLT NO.  | ORBITER   | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET  | ORBIT   |  | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|--|--|---|---|--|---|--|--|--|---|
| STS-39<br>SEQ FLT #40<br>KSC-40<br><br>PAD 39A-28 MLP-2                            | OV-103<br>Discovery (Flight 12)<br><br>OMS PODS<br>LPO4 - 9<br>RPO3 - 13<br>FRC3 - 12 | CDR:<br>Michael L. Coats<br>(Flt 3 - STS 41-DR & STS-29)<br>P205/R38/V39/M37<br>PLT:<br>L. Blaine Hammond<br>P206/R124/M111<br>M/S 1:<br>Gregory J. Harbaugh<br>P207/R125/M112<br>M/S 2:<br>Donald McMonagle<br>P208/R126/M113<br>M/S 3:<br>Guion S. Bluford<br>(Flt 3 - STS-8 & STS 61-A)<br>P209/R22/V25/M21<br>M/S 4:<br>Charles Lacy Veach<br>P210/R127/M114<br>M/S 5:<br>Richard J. Hieb<br>P211/R128/M115<br><br>MCC FCR-1 (20)<br>FLIGHT DIRECTORS:<br>Asc/Ent - A. L. Briscoe<br>Ld/O2 - R. D. Dittmore<br>O 1 - R. E. Castle<br>O 3 - R. M. Kelso<br>MOD - T. W. Holloway | KSC 39A<br>118:11:33:14Z<br>7:01:00 AM EDT (P)<br>7:33:14 AM EDT (A)<br>Sunday 5<br>4/28/91 (8)<br><br>LAUNCH WINDOW<br>3H20M<br>(AURORA CONSTR)<br><br>PLS: EDW LKBD<br>TAL: ZZA (P)<br>TAL ALT:<br>BEN GUERIR<br>MORON<br><br>SELECTED:<br>RTLS: KSC 33/CI<br>TAL: BEN 36/CI<br>AOA: EDW 22<br><br>TDEL:<br>-0.64<br><br>MAX Q:<br>709<br><br>SRB STG:<br>2:03.4<br><br>PERF: Nominal<br><br>2 ENG TAL (BEN):<br>2:49<br><br>NEG RETURN:<br>4:06<br><br>PTA: (ATO)<br>4:56<br><br>PTM:<br>6:09<br>VI:<br>25804<br><br>OMS-2:<br>Tiq =36:08<br>DV=209.6 FPS | KSC 15 (KSC-7)<br>126:18:55:35Z<br><br>2:55:35 PM EDT<br>Monday 10<br>5/6/91 (3)<br><br>DEORBIT BURN:<br>126:17:53:34Z<br><br>X RANGE: 616 NM<br><br>ORB DIR: DL 21<br><br>AIM PT: CLOSEIN<br><br>MLGTD: 169 FT<br>126:18:55:35<br>VEL: 210 KGS<br>218 KEAS<br>HDOOT: - 2 FPS<br><br>TD NORM 195:<br>2771 FT<br><br>NLGTD: 4700 FT<br>126:18:55:49<br>VEL: 157KGS<br>HDOOT: - 2.9 FPS<br><br>BRK INIT:136 KGS<br><br>AVE BRK DECEL:<br>9.5 FPS/S<br><br>WHEELS STOP:<br>126:18:56:31<br>9403 FT<br><br>ROLLOUT:<br>9234 FT<br>56 Seconds<br><br>WINDS:<br>12H, 1R KTS<br>OFFICIAL: 14H, 2R<br><br>DENS ALT:1723FT<br><br>FLT DURATION:<br>8:07:22:21<br>199:22:21<br><br>S/T: 237:16:53:30<br><br>OV-103:<br>69:17:40:41<br><br>DISTANCE:<br>3,475,000 sm | 104/104/<br>109%<br><br>ACTUAL:<br>100/100/<br>94/70/<br>104/67<br><br>1 = 2026 (1)<br>2 = 2030 (5)<br>3 = 2029 (4)<br><br>M 3 EOM<br><br>WEIGHT:<br>211673<br><br>X CG: 1080.3<br><br>LANDING<br><br>WEIGHT:<br>211512<br><br>X CG: 1082.0<br><br>DEORBIT<br>140 X<br>138 NM<br><br>VELOCITY<br>25765 FPS<br><br>ENTRY<br>RANGE<br>4502 NM | BI-043<br><br>RSRM<br>15K<br><br>ET-46<br>LWT-39<br><br>ET<br>RPT<br>249K<br>1:09:34<br>MET<br><br>ET<br>BR/UP<br>215K<br>1:10:34<br>MET<br><br>ET<br>IMPACT<br>LAT:<br>43.82°S<br>LONG:<br>156.3°W<br><br>STS039-17-017 1991-05-06,<br>Shuttle Pallet Satellite II (SPAS-II)/Infrared Background Signature Survey (IBSS) released by RMS. | 57.007°<br>(7)<br><br>DIRECT<br>INSERTION<br><br>INSERTION<br>ALTITUDE:<br>140.02 X<br>138.22 NM<br><br>SPAS<br>DEPLOY:<br>137.37 X<br>136.55 NM<br><br>CRO-C<br>DEPLOY:<br>136.4 X<br>134.7 NM<br><br>CRO-B<br>DEPLOY:<br>136.7 X<br>132.7 NM<br><br>SPAS RNDZ:<br>135.5 X<br>132.8 NM<br><br>CRO-A<br>DEPLOY:<br>140.96 X<br>138.6 NM<br><br>MPEC<br>DEPLOY:<br>141.55 X<br>139.46 NM | OI-8F<br>(2)<br><br>CARGO:<br>26294 LBS<br><br>PYLD CHARGABLE:<br>21413 LBS<br><br>DEPLOYABLE:<br>827 LBS<br><br>NON-DEPLOYED:<br>16046 LBS<br><br>RETURNED:<br><br>MIDDECK:<br>494 LBS<br><br>SHUTTLE ACCUM<br>WEIGHTS:<br>DEPLOYED:<br>550440 LBS<br>NON-DEPLOYED:<br>454356 LBS<br>CARGO TOTAL:<br>1142128 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4653<br>FUEL BIAS: 994<br>FINAL TDDP:1054<br>RECON: 2768<br><br>PAYLOADS:<br>PLB:<br>Infrared Background<br>Signature Survey<br>(IBSS) (SPAS-II (IV<br>+ 3 GAS DEPLOY<br>CRO-A, CRO-B,<br>CRO-C, CIV)<br><br>AF-675 (CIRRIS,<br>FAR-UV, URA, HUP,<br>QINMS)<br><br>STP-1 (ALFE, APM,<br>SKIRT, UVIM, DSE)<br><br>MPEC - GAS DPLY<br><br>MIDDECK:<br>CLOUDS-1A<br>RME-III<br>UVPI<br><br>4 CRYO TK SETS<br><br>RMS 24 (S.N. 301)<br>USED FOR<br>SPAS/IBSS DPLY,<br>CAPTURE, AND<br>BERTH | KSC W/D: OPF 116 (2), VAB 17 (3), PAD 47 (2) = 180<br><br>LAUNCH POSTPONEMENTS:<br>- As of 8/21/90, launch date is 2/26/91.<br>- 2/26/91 launch postponed to 3/9/91 due to OMS pod work. (Swapped RP-03 from OV-104 for RP-01.)<br>- On 2/15/91, cracks found in OV-103 ET door hinge brackets. On 2/28/91, decision made to roll back and repair ET doors resulting in STS-39 launch being scheduled after STS-37. Launch rescheduled for 4/23/91.<br>- 56 days total slip based on 8/21/90 schedule.<br><br>LAUNCH SCRUBS:<br>- 4/23/91 launch scrubbed at L-6 hours due to SSME #3 HPOTP secondary seal pressure xducer problem and P/L servicing. Rescheduled launch for 4/28/91.<br>- 5-day slip. (Total slip - 61 days.)<br><br>LAUNCH DELAYS:<br>- 32M14S delay caused by review of OPS 2 recorder uncommanded switching of tracks and going to run at approximate time of BFS 101 PRO.<br><br>TAL WX:<br>- Zaragoza and Moron no go - ceilings (broken < 8000 feet).<br><br>I-LOADS:<br>- LSEAT selected nominal, no uplink.<br><br>FLIGHT DURATION/LANDING SITE CHANGES:<br>- Landed at KSC on same rev as planned for EDW because unfavorable winds predicted at EDW.<br><br>EVENTS:<br>- SPAS deploy - rev 46, SPAS RNDZ - rev 72, MPEC deploy - rev 127.<br>- 16 OMS burns.<br><br>RENDEZVOUS 9: With Infrared Background Signature Survey (IBSS) (SPAS-II) for retrieval and return.<br><br>FIRSTS:<br>- First flight with 67% as standard 3g throttling.<br><br>SIGNIFICANT ANOMALIES:<br>- ROB tire outboard shoulder damaged during landing (3 cords).<br>- OPS 2 recorder uncommanded switching of tracks and tape speed prelaunch.<br>- FES feedline A system 2 heater failure.<br>- APU 2 fuel pump/GGVM coolant sys A valve did not operate.<br>- GFE tread mill excessive resistance. |  |   |
| 039-07-017 STS-39 Crew On-Orbit  |   |  |  |   |   |  |   |  |  |  |   |
|  |   |  |    |   |   |  |   |  |  |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER   | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM<br><br>AND ET   | ORBIT   |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|---|---|--|---|--|---|---|--|--|---|
| STS-40<br><br>SEQ FLT #41<br><br>KSC-41<br><br>PAD 39B-13<br><br>MLP-3             | OV-102 Columbia (Flight 11)<br><br>Sixth Spacelab Flight<br><br>LM (4)<br><br>First Life Sciences Flight<br><br>OMS PODS LPO3 - 11 RPO4 - 7 FRC2 - 11 | CDR:<br>Bryan D. O'Connor (Flt 2 - STS 61-B) P212/R83/V61/M76<br><br>PLT:<br>Sidney M. Gutierrez P213/R129/M116<br><br>M/S 1:<br>James P. Bagian (Flt 2 - STS-29) P214/R99/V62/M90<br><br>M/S 2:<br>Tamara E. Jernigan P215/R130/F14<br><br>M/S 3:<br>Rhea Seddon (Flt 2 - STS 51-D) P216/R55/V63/F5<br><br>P/S 1:<br>F. Drew Gaffney P217/R131/M117<br><br>P/S 2:<br>Millie Hughes-Fulford U of Cal/VA Center P218/R132/F15<br><br>MCC FCR-1 (21)<br>FLIGHT DIRECTORS:<br>Asc/Ent - N. W. Hale<br>Ld/O2 - G. A. Pennington<br>O 1 - R. E. Castle<br>Plng - J. W. Bantle<br>MOD - B. R. Stone | KSC 39B<br><br>156:13:24:51Z<br>8:00:00 AM EDT (P)<br>9:24:51 AM EDT (A)<br>Wednesday 5<br>6/5/91 (4)<br><br>LAUNCH WINDOW:<br>2H00M (MAND SLS-1 SCIENCE)<br><br>PLS: EDW LKBD<br>TAL: BEN GUERIR<br>TAL ALT: MORON ZARAGOZA<br><br>SELECTED:<br>RTLS: KSC 33/CI/N<br>TAL: BEN 36/N/N<br>AOA: EDW 22<br>PLS: EDW 22<br><br>TDEL: -0.32<br><br>MAX QNAV: 681<br><br>SRB STG: 2:04.2<br><br>PERF: NOMINAL<br><br>2 ENG TAL: 2:57<br><br>NEG RETURN: 4:02<br><br>PTA: 5:15<br><br>PTM: 5:45<br><br>MECO CMD: 8:31.2<br><br>VI: 25850<br><br>OMS-2: Tig = 2:05 DV = 199 FPS | EDW 22, CONC (EDW 32, CONC 14)<br>165:15:39:11Z<br><br>8:39:11 AM PDT<br>Friday 5<br>6/14/91 (3)<br><br>XRANGE: 211 NM<br><br>ORB DIR: DR 6<br><br>AIM PT: NOMINAL<br><br>MLGTD: 1485 FT<br>165:15:39:11Z<br>VEL: 199 KGS 203 KEAS<br>HDOT: -2 FPS<br><br>TD NORM 195: 2202 FT<br><br>NLGTD: 5914 FT<br>165:15:39:25Z<br>VEL: 153 KGS<br>HDOT: -4 FPS<br><br>BRK INIT: 134 KGS<br><br>AVE BRK DECEL: 6.8 FPS/S<br><br>WHEELS STOP: 165:15:40:06Z<br>10923 FT<br><br>ROLLOUT: 9438 FT<br>55 SECONDS<br><br>WINDS: 10.4H, 6 L KTS<br>OFFICIAL: 12H, 3L<br><br>DENS ALT: 3739 FT<br><br>FLT DURATION: 9:02:14:20<br>218:14:20<br><br>S/T: 246:19:07:50<br><br>OV-102: 75:01:14:24<br><br>DISTANCE: 3,290,226 sm | 104/104/109%<br><br>PREDICTED: 100/100/92/67/104/67<br><br>ACTUAL: 100/100/98/71/104/67<br><br>1 = 2015 (6)<br>2 = 2022 (6)<br>3 = 2027 (6)<br><br>M 3 EOM WEIGHT: 226737<br>X CG: 1279.6<br><br>LANDING WEIGHT: 226535<br>X CG: 1080.9 | BI-044<br><br>RSRM 16W<br><br>ET-41 LWT-34<br><br>ET RPT 244K 1:19:40 MET<br><br>ET BR/UP 197K 1:20:52 MET<br><br>ET IMPACT LAT: 1.05°N<br>LONG: 146.06°W                                | 39.0156° (1)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 161.16 X 149.84 NM<br><br>DEORBIT 157 X 146 NM<br><br>VELOCITY 25772 FPS<br><br>ENTRY RANGE 4339 NM | OI-8D (4)<br><br>CARGO: 33707 LBS<br><br>PAYLOAD CHARGEABLE: 28114 LBS<br><br>DEPLOYED: 0 LBS<br><br>NON-DEPLOYED: 26237 LBS<br><br>RETURNED:<br><br>MIDDECK: 1877 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: 550440 LBS<br>DEPLOYED: 482470 LBS<br>NON-DEPLOYED: 1175835 LBS<br>CARGO TOTAL: 1175835 LBS<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 4671<br>FUEL BIAS: 983<br>FINAL TDDP:3037<br>RECON: 4212<br><br>PAYLOADS:<br>PLB: Spacelab Life Sciences-1 (SLS-1)/LM<br>Cardiovascular, Cardiopulmonary Metabolic, Musculoskeletal, and Neurovestibular Systems Experiments<br><br>GBA With 12 GAS<br><br>MIDDECK: MODE-0<br><br>5 CRYO TK SETS<br><br>NO RMS | KSC W/D: OPF 74, VAB 6, PAD 34 = 114 days<br><br>LAUNCH POSTPONEMENT:<br>- 1/9/91 launch date as of 8/21/90. Launch order was STS-35, STS-41, STS-38, STS-40, STS-39, and STS-37. Launch postponed due to STS-35 and STS-38 H <sub>2</sub> leaks. Program manifest in March set tentative schedule of 5/22/91 with STS-37 and STS-39 moved ahead of STS-40.<br>- 129-day slip.<br><br>LAUNCH SCRUBS:<br>- 5/22/91 launch scrubbed at approximately L-1 day (during T-11 hr hold) due to (1) MDM FA2 problem, (2) GPC4 failure, and (3) SSME cryo temp probes analysis received stating probes could break and enter HP turbopumps. Changed LO <sub>2</sub> and LH <sub>2</sub> temperature transducers. Launch rescheduled for 6/1/91. 10-day turnaround.<br>- 6/1/91 launch scrubbed at T-20 minute hold due to IMU 2 failing calibration. 96-hour turnaround.<br><br>LAUNCH DELAYS:<br>- 1H24M51S delay at T-9 minute hold due to RSO no-go for ceiling at 12K. (Moisture in middle clouds and greater than 4500 feet thick.)<br><br>TAL WX:<br>- Ben Guerir (P) go throughout (selected).<br>- Moron go throughout - Zaragoza go.<br><br>RTLS:<br>- KSC 15/33 ceiling 12K with middle clouds thicker than 4500 ft caused delay.<br><br>I-LOADS:<br>- LSEAT selected nominal, no uplink required.<br><br>SIGNIFICANT ANOMALIES:<br>- Two ECOS failures.<br>- Hum sep A speed sensor wire break.<br>- PRSD H <sub>2</sub> tank 3 heater failure.<br>- MECO velocity error (explained condition).<br>- KSC wind tower data false wind gusts.<br>- S-band degraded performance on lower antennas.<br>- TAGS hardcopier jam.<br>- PLBD seal section missing and 1307 bulkhead blankets unfastened.<br>- LiOH door stuck closed (IFM freed door).<br>- Camcorder adapter cable failure.<br>- APU 1 fuel line heater failure.<br>- Vernier jet L5L fail off.<br>- S/L audio problem.<br>- Orbiter freezer and L9I ref/freezer Freon freezepup. |  |   |
|    |   |   |   |  |   |  |   |   |  |  |   |
| STS040-610-010<br>1991-06-14<br>Spacelab Life Sciences-1 (SLS-1 in P/L Bay         |   |   |   |  |   |  |   |   |  |  |   |
|  |   |   |   |  |   |  |   |   |  |  |   |
|  |   |   |   |  |   |    |   |   |  |  |   |
|  |   |   |   |  |   | STS040-605-009 1991-06-14 STS-40<br>Crew: Front row (lt to rt) Gaffney/PS, PLT Gutierrez, Seddon/MS, & Bagian/MS.<br>Back row (lt to rt) CDR O'Connor, Jernigan/MS, & Hughes-Fulford/MS. |   |   |  |  |   |

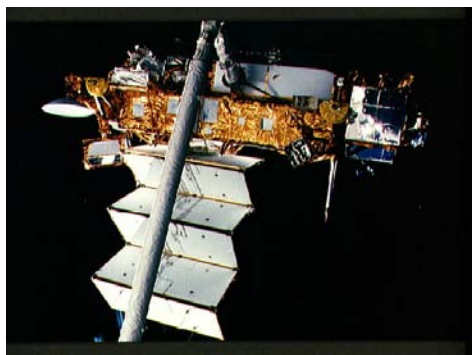
## Page 2-49 - STS-43

| FLT NO.   | ORBITER  | CREW (5)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N. | SRB RSRM<br><br>AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|--------------------------------------|--|---|---|------------------------|-------|--|-----|---|---|
| STS-43<br><br>SEQ FLT #42<br><br>KSC-42<br><br>PAD 39A-29 MLP-1 | OV-104 (Flight 9) Atlantis<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br> |                                      |  |   |   |                        |       |  |     |   |   |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-50 - STS-48

| FLT   | ORBITER   | CREW<br>(5)   | LAUNCH SITE,<br>LIFTOFF TIME,  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-<br>ABORT<br>EMERG  | SRB<br>RSRM  | ORBIT         |  | FSW  | PAYLOAD<br>WEIGHTS,  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,                         |
|---|---|---|--|---|--|--|---------------|--|--|--|--|
| NO.   |   | TITLE, NAMES<br>& EVA'S   | LANDING SITES,<br>ABORT TIMES  | LANDING TIMES<br>FLT DURATION,<br>WINDS   | THROTTLE<br>PROFILE<br>ENG. S.N.   | AND<br>ET  | INC           | HA/HP  |  | PAYLOADS/<br>EXPERIMENTS   | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
| STS-48<br><br>SEQ FLT #43<br><br>KSC-43<br><br>PAD<br>39A-30<br>MLP-3 | OV-103<br>(Flight 13)<br>Discovery<br><br><br><br><br><br>OMS PODS<br>LPO4 - 10<br>RPO3 - 14<br>FRC3 - 13 | CDR:<br>John O. Creighton<br>(Flt 3 - STS 51-G,<br>& STS-36)<br>P224/R63/V50/M58<br><br>PLT:<br>Kenneth S. Reightler<br>P225/R134/M119<br><br>M/S 1:<br>James F. Buchli<br>(Flt 4 - STS 51-C,<br>STS 61-A, & STS-29)<br>P226/R52/V24/M48<br><br>M/S 2:<br>Mark N. Brown<br>(Flt 2 - STS-28)<br>P227/R103/V66/M94<br><br>M/S 3:<br>Charles D. (Sam) Gemar<br>(Flt 2 - STS-38)<br>P228/R118/V67/M106<br><br>MCC FCR-1 (23)<br>FLIGHT DIRECTORS:<br>Asc/Ent - J. W. Bantle<br>Ld/O1 - G. A. Pennington<br>O 2 - R. M. Kelso<br>Plng - P. L. Engelauf<br>MOD - G. E. Coen | KSC 39A<br>255:23:11:04Z<br>6:57:00 PM EDT (P)<br>7:11:04 PM EDT (A)<br>Thursday 10<br>9/12/91 (2)<br><br>LAUNCH WINDOW:<br>2H57M (UARS<br>RAAN & CTOB)<br><br>PLS: KSC<br>TAL: ZARAGOZA<br>TAL ALT: MOR, BEN<br><br>SELECTED:<br>RTLS: KSC33/NOM<br>NOM 2400 FT<br><br>TAL: ZZA30/CI<br>NOM 2900 FT<br><br>AOA: NOR 17/NOM/<br>NOM 2900 FT<br><br>PLS: EDW22/NOM/<br>NOM 2700 FT<br><br>TDEL:<br>-0.16      0.162/0.2<br><br>MAX Q NAV:<br>670      708<br><br>SRB STG:<br>2:04      2:05.23<br><br>PERF: NOMINAL<br><br>2 ENG TAL ZZA:<br>2:19      2:22<br><br>NEG RETURN:<br>4:09      4:14<br><br>PTA (U/S 518):<br>4:23      4:23<br><br>PTM (U/S 1124):<br>6:44      6:50<br><br>MECO CMD:<br>8:36      8:36<br><br>VI:<br>26087      26083<br><br>OMS-2 TIG:<br>43:39      43:40<br>448 FPS      450 FPS | EDW 22 NOM<br>(EDW 33, CONC 15)<br>261:07:38:42Z<br>00:38:42 AM PDT<br>Wednesday 4<br>09/18/91 (4)<br><br>XRANGE: 690 NM<br><br>ORBIT DIR: DR 7<br><br>AIM PT: NOMINAL<br><br>MLGTD: 1235 FT<br>261:07:38:42Z<br>VEL: 213 KGS<br>203 KEAS<br>HDOT: -1 FPS<br><br>TD NORM 195:<br>2015 FT<br><br>NLGTD: 4882 FT<br>261:07:38:53Z<br>VEL: 171 KGS<br>HDOT: -2.1 FPS<br><br>BRK INIT: 145 KGS<br><br>AVE BRK DECEL:<br>8.2 FPS/S<br><br>WHEELS STOP:<br>10619 FT<br><br>ROLLOUT:<br>9384 FT<br>49 SECS<br><br>WINDS:<br>2.9H, 0.8 L KTS<br>OFFICIAL: 4H, 4L<br><br>DENS ALT: 3503 FT<br><br>FLT DURATION:<br>5:08:27:38<br>128:27:38<br><br>S/T: 261:00:56:53<br><br>OV-103:<br>75:02:08:19<br><br>DISTANCE:<br>2,193,670 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/100/<br>89/67/<br>104/67<br><br>ACTUAL:<br>100/100/<br>89/67/<br>104/67<br><br>1 = 2019 (9)<br>2 = 2031 (6)<br>3 = 2107 (5)<br><br>M 3 EOM<br><br>WEIGHT:<br>192925<br><br>X CG:<br>1096.0<br><br>LANDING:<br><br>WEIGHT:<br>192780<br><br>X CG:<br>1097.8 | BI-046<br><br>RSRM<br>18W<br><br>ET-42<br>LWT-35<br><br>ET<br>RPT<br>229K<br>1:25:46<br>MET<br><br>ET<br>BR/UP<br>194K<br>1:26:47<br>MET<br><br>ET<br>IMPACT<br>LAT:<br>0.26°N<br>LONG:<br>121.9°W<br><br>WEIGHT:<br>192780<br><br>X CG:<br>1097.8 | 57.00°<br>(8) | DIRECT<br>INSERTION<br><br>288 X<br>36 NM<br><br>POST OMS-2:<br>291.5 X<br>289.9 NM<br><br>RCS-1:<br>306.9 X<br>290.9 NM<br><br>RCS-2:<br>308.1 X<br>207.9 NM<br><br>UARS<br>DEPLOY:<br>308.9 X<br>305.3 NM<br><br>ENTRY:<br>Ha/HP:<br>313 X 302 NM<br><br>VELOCITY<br>26077 FPS<br><br>RANGE<br>4194 NM | OI-20<br>(2)<br><br>CARGO:<br>21564 LBS<br><br>PAYLOAD<br>CHARGABLE:<br>17144 LBS<br><br>DEPLOYED:<br>14388 LBS<br><br>NON-DEPLOYED:<br>2066 LBS<br><br>MIDDECK:<br>690 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>602403 LBS<br>NON-DEPLOYED:<br>494363 LBS<br>CARGO TOTAL:<br>1246729 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4671<br>FUEL BIAS: 983<br>FINAL TDDP: 510<br>RECON: - 562<br><br>PAYLOADS:<br>PLB:<br>Upper Atmosphere<br>Research Satellite<br>(UARS) with 10<br>experiments<br>deployed:<br>SUSIM, SOLSTICE,<br>PEM, CLAES,<br>ISAMS, MLS,<br>HALOE, HRDI,<br>WIND II, ACRIM-II,<br>APM<br><br>MIDDECK:<br>PCG-II-2<br>RME-III<br>MODE<br>IPMP<br>AMOS<br>PARE<br>SAM<br>CREAM<br><br>4 CYRO TK SETS<br><br>RMS 25 (S.N. 301)<br>used for UARS<br>deploy | KSC W/D: OPF 78, VAB 8, PAD 27 = 101 days<br><br>LAUNCH ADVANCEMENT:<br>- Launch advanced 9 days from 9/21/91 to 9/12/91,<br>which was the earliest date to complete crew training<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS:<br>- 14M4S because of motor boating noise on A/G voice<br>caused by glitch on RF to MILA resulting in Delta<br>Modulation System (DMS) false frame lock. Counted to<br>T-5 mins, held and cleared by CDR keying A/G voice.<br><br>TAL WX: Zaragoza, Moron, and Ben Guerir - all go.<br><br>DOLILU/ALT I-LOADS:<br>- First availability of DOLILU which was uplinked and<br>used (uplink 7).<br><br>DUSK LAUNCH:<br>- Launch was planned during daylight but 14 minute<br>delay slipped to dusk launch, RTLS would have been<br>night.<br><br>FLIGHT DURATION CHANGES:<br>- Waved off planned rev at KSC because STA observed<br>clouds developing south of SLF.<br>- Flight extended one rev when STA spotted clouds<br>forming south of SLF. Clouds were not observed on<br>radar.<br><br>FIRSTS:<br>- First flight of enhanced MDM (OA1 only).<br><br>LANDING SITE CHANGE:<br>- Changed from KSC to EDW because of the dynamic<br>conditions with clouds and convection observed by<br>STA.<br>- One rev extension.<br><br>EVENTS: UARS deployed at MET 2:05:12:09. SEP 1<br>burn at 2:05:12:40.<br><br>NIGHT LANDING: Space Shuttle #5<br><br>SIGNIFICANT ANOMALIES:<br>- ET door centerline latch 1 motor 2 phase B failure.<br>- Fuel cell 1 O <sub>2</sub> reactant valve closed indication.<br>- Supply water dump valve leaking.<br>- Hydraulic system 2 unloader valve leakage.<br>- Supply water nozzle temperature temporary decrease.<br>- APU 1 seal cavity drain pressure delay.<br>- LINHOV camera failed. |  |



STS048-05-024 1991-09-18 Upper Atmosphere Research Satellite (UARS)



STS048-21-004 1991-09-18 Crew on middeck: (front lt to rt) PLT Reightler, CDR Creighton, Buchli/MS and (back lt to rt) Brown/MS & Gemar/MS.



## Page 2-51 - STS-44

| FLT NO.          | ORBITER                          | CREW (6)   | LAUNCH SITE, LIFTOFF TIME,  | LANDING SITE/ RUNWAY, CROSSRANGE  | SSME-TL NOM-ABORT EMERG   | SRB RSRM  | ORBIT       |                  | FSW       | PAYLOAD WEIGHTS,   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |  |  |  |
|------------------|----------------------------------|--|---|---|---|---|-------------|------------------|-----------|--|---|--|--|--|
|                  |                                  | TITLE, NAMES & EVA'S   | LANDING SITES, ABORT TIMES  | LANDING TIMES FLT DURATION, WINDS   | THROTTLE PROFILE ENG. S.N.  | AND ET  | INC         | HA/HP            |           | PAYLOADS/ EXPERIMENTS  |   |  |  |  |
| STS-44           | OV-104 (Flight 10) Atlantis      | CDR: Frederick D. Gregory (Flt 3 - STS 51-B & STS-33) P229/R59/V47/M54   | KSC 39, PAD A 328:23:44:00Z 6:31:00 PM EST (P) 6:44:00 PM EST (A) Sunday 6 11/24/91 (8) | EDW 05 (EDW 34, LKBD 19) 335:22:34:43Z 2:34:43 PM PST Sunday 7 12/1/91 (5)  | 104/104/ 109%<br><br><u>PREDICTED</u><br>100/104/ 104/70/ 104/67<br><br><u>ACTUAL</u><br>100/104/ 104/73/ 104/67<br><br>1 = 2015 (7)<br>2 = 2030 (6)<br>3 = 2029 (5)  | BI-047<br><br>RSRM 19W<br><br>ET-53 LWT-46<br><br>ET RPT 235K 1:19:55 MET<br><br>ET BR/UP 207K 1:20:38 MET<br><br>ET IMPACT LAT: 17.01°N LONG: 154.05°W | 28.45° (27) | DIRECT INSERTION | OI-20 (3) | CARGO: 47235 LBS<br><br>PAYLOAD CHARGEABLE: 44637 LBS<br><br>DEPLOYED: 37588 LBS<br><br>NON-DEPLOYED: 5809 LBS<br><br>MIDDECK: 1240 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 639991 LBS NON-DEPLOYED: 501412 LBS CARGO TOTAL: 1293964 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 4356 FUEL BIAS: 1337 FINAL TDDP: 565 RECON: 1025<br><br>PAYLOADS: PLB: DEFENSE SUPPORT PROGRAM (DSP)/IUS (DEPLOYED) IOCM<br><br>MIDDECK: MSS-1 AMOS CREAM SAM RME-III VFT-1 TERRA-SCOUT UVPI<br><br>4 CRYO TK SETS<br><br>NO RMS | KSC W/D: OPF 67, VAB 5, PAD 31 = 103 days<br><br><u>LAUNCH POSTPONEMENTS:</u><br>- As of 8/21/90, launch date was 7/5/91.<br>- Postponed launch date to 11/15/91 caused by STS-38 and STS-35 H <sub>2</sub> leaks. Postponed to 11/19/91 due to STS-43 delays impacted MLP availability and WLE tee splice replacement.<br><br><u>LAUNCH SCRUB:</u><br>- Scrubbed 11/19/91 launch at T-9 hours because one IMU in IUS RIMU experienced BITE indications. Rescheduled launch for 11/24/91 to replace IUS RIMU. 5-day slip. 142 days total slip.<br><br><u>LAUNCH DELAYS:</u><br>- 11/24/91 launch was delayed 13MOS at T-9 minutes to torque down packing in a leaking LO <sub>2</sub> replenish valve and to avoid a COLA at 6:38 pm EST.<br><br>TAL WX: Banjul (prime) and Ben Guerir were go. Moron predicted no go (ceiling) but was observed go.<br><br>ALT I-LOADS:<br>- Second flight with DOLILU capability. Nominal selected. No uplink required.<br><br>NIGHT LAUNCH: Shuttle night launch #7.<br><br>LANDING SITE CHANGE: Loss of one IMU caused MDF and lakebed landing, hence changed to EDW from KSC.<br><br>FLIGHT DURATION CHANGES:<br>- Extended one rev at EDW because of predicted high winds.<br>- Flight shortened nearly 3 days due to IMU 2 failure.<br><br>FIRSTS:<br>- First flight of HAINS ALT IMU (IMU-1 only).<br>- First flight of color CCTV monitors.<br><br>SECOND SHUTTLE CREWMEMBER REPLACEMENT:<br>David Walker was replaced by Gregory in 1990. (First Shuttle crewmember replacement occurred on STS-33.)<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Left SSME MCC P Xducer B BIAS ~30 PSIA high.<br>- Supply water dump valve leaking after water dump.<br>- HUMIDITY SEP B leaking water.<br>- IMU 2 FAIL (Z AXIS ACCEL) - caused MDF and lakebed landing.<br>- Left AIR DATA PROBE single motor deploy.<br>- VCR tape door problem.<br>- TREADMILL failed.<br>- 16 mm ARRIFLEX malfunctioned.<br>- APU 2 FUEL PUMP seal cavity drain line valve failure. |  |  |  |
| SEQ FLT #44      |                                  | PLT: Terence (Tom) Henricks P23/0R135/M120<br><br>M/S 1: James S. Voss P231/R136/M121<br><br>M/S 2: F. Story Musgrave (Flt 4 - STS-6, STS 51-F & STS-33) P232/R15/V19/M15<br><br>M/S 3: Mario Runco, Jr P233/R137/M122<br><br>P/S: Thomas J. Hennen CWO-3, U.S. Army P234/R138/M123<br><br>MCC FCR-1 (24)<br><br>FLIGHT DIRECTORS: Asc/Ent - R.D. Dittmore Ld/O 2 - J. M. Heflin O 1 - P. L. Engelauf Plng - C. W. Shaw MOD - T. W. Holloway |   | LAUNCH WINDOW 1H59M (DSP RAAW)<br><br>EOM PLS: KSC<br>TAL: BYD 32<br>TAL WX: BEN , MRN<br><br>SELECTED: RTLS: KSC 33/CI/N TAL: BYD 32/N/SF AOA & PLS: EDW 22/N/N<br><br>TDEL: -0.16 0.442/0.48<br><br>MAX ON: 719 PSF 728 PSF<br><br>SRB STG: 2+05 2+05<br><br>PERF: NOM<br><br>2 ENG TAL BYD: 2+41 2+40<br><br>NEG RETURN: 3+57 4+00<br><br>PTA (U/S 315): 5+06 5+09<br><br>PTM (U/S 315): 5+57 6+00<br><br>MECO CMD: 8+28.5 8+30<br><br>VI: 25934 25928<br><br>OMS-2 TIG: 4+49 4+48<br><br>S/T: 267:23:47:36<br><br>OV-103: 55:12:28:32<br><br>DISTANCE: 2,890,067 sm | XRANGE: 379 NM<br><br>ORBIT DIR: AL 12<br><br>AIM PT: CLOSEIN<br><br>MLGTD: 2607 FT 335:22:34:43Z VEL: 182 KGS 189 KEAS HDOT: -1 FPS<br><br>TD NORM 195: 2127 FT<br><br>NLGTD: 5077 FT 335:22:34:51Z VEL: 149 KGS HDOT: -5.2 FPS<br><br>BRK INIT: 15 KGS<br><br>AVE BRK DECEL: 1.8 FPS/S<br><br>WHEELS STOP: 335:22:36:29Z 13798 FT<br><br>ROLLOUT: 11191 FT 106 SEC<br><br>WINDS: HT12.8 KTS R2.2 KTS OFFICIAL: 13H, 0L<br><br>DENS ALT: 2284 FT<br><br>FLT DURATION: 6:22:50:43 166:50:43<br><br>S/T: 267:23:47:36<br><br>OV-103: 55:12:28:32<br><br>DISTANCE: 2,890,067 sm |   |             |                  |           |  |   |  |  |  |
| KSC-44           |                                  |  |   |   |   |   |             |                  |           |  |   |  |  |  |
| PAD 39A-31 MLP-1 | OMS PODS LPO1-16 RPO1-16 FRC4-10 |  |   |   |   |   |             |                  |           |  |   |  |  |  |

STS044-17-030 1991-12-01 Crew: featuring "Trash Man" Hennen/PS (front ctr) star of onboard video on disposal of trash. Others (front row) CDR Gregory (left) & Voss/MS and (back row lt to rt) Runco/MS, Musgrave/MS, & PLT Henricks.

STS044-71-011 1991-12-01--- DSP/IUS Spacecraft in P/L Bay tilted for deploy.

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.          | ORBITER                          | CREW (7)  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG                      | SRB RSRM                            | ORBIT   |                      | FSW       | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|------------------|----------------------------------|---|--|--|--|-------------------------------------|---------|----------------------|-----------|--|---|
|                  |                                  | TITLE, NAMES & EVA'S  |  |  |  |                                     | INC     | HA/HP                |           |  |   |
| STS-42           | OV-103 (Flight 14) Discovery     | CDR: Ronald J. Grabe (Flt 3 - STS 51-J & STS-30) P235/R76/V41/M70   | KSC 39, PAD A 22:14:52:33Z 8:53:00 AM EST (P) 9:52:33 AM EST (A) Wednesday 6 01/22/92 (5)          | EDW 22 (EDW 35, CONC 16) 30:16:07:17Z 8:07:17 AM PST Thursday 3 01/30/92 (4) | 104/104/ 109%                                | BI-048                              | 57° (9) | DIRECT INSERTION     | OI-20 (4) | CARGO: 32364 LBS   | KSC W/D: OPF 75, VAB 6, PAD 24 = 105 days   |
| SEQ FLT #45      | Seventh Spacelab Long Module (5) | PLT: Steven S. Oswald P236/R139/M124  |  |  | PREDICTED 100/100/ 100/70/ 104/67            | RSRM 20W                            |         |                      |           | PAYLOAD CHARGEABLE: 28663 LBS  | LAUNCH POSTPONEMENTS:<br>- As of 12/19/90, launch date was 11/15/91.<br>- Postponed to 1/13/92 as of 3/15/91. 26-day slip.<br>- Postponed to 1/22/92 as of 8/21/91. 9-day slip.<br>- 35 days total launch slip.   |
| PAD 39A-32 MLP-3 | OMS PODS LPO4-11 RPO3-15 FRC3-14 | M/S 1 (P/L CDR): Norman E. Thagard (Flt 4 - STS-7, STS 51-B, STS-30) P237/R20/V14/M19                                 | LAUNCH WINDOW 2H49M (EOM/ TAL LIGHTING)  | XRANGE: 536 NM   | ACTUAL 100/100/ 100/75/ 104/67               | ET 243K 1:09:33 MET                 |         |                      |           | DEPLOYED: 0 LBS  | LAUNCH SCRUB: None.   |
|                  |                                  | M/S 2: William F. Readdy P238/R140/M125   | PLS: EDW TAL: ZZA (P) TAL WX: MRN, BEN   | AIM PT: NOMINAL  | 1 = 2026 (2)<br>2 = 2022 (7)<br>3 = 2027 (7) | ET 222K 1:10:08 MET                 |         | DEORBIT 160 X 157 NM |           | NON-DEPLOYED: 26453 LBS  | LAUNCH DELAYS:<br>- 1/22/92 launch was delayed 59M33S at T-9 minutes caused by: (1) Paper closure of FC2 H <sub>2</sub> Pump/AC; Bus anomaly, (2) KSC field mills read >1 KVOLT/meter (determined to be caused by salt fog), (3) Excessive O <sub>2</sub> in mid-body, (4) "BLAST" program violation, and (5) KSC field mills read >1 KVOLT/meter (STA confirmed moisture in cloud passing over field mills).   |
|                  |                                  | M/S 3: David C. Hilmers (Flt 4 - STS 51-J, STS-26, STS-36) P239/R77/V36/M71   | SELECTED: RTLS: KSC 33/N/N TAL: ZZA 30/C/I/N AOA: N/A PLS: EDW 22/N/N (REV 3) EDW 04/C/I/N (REV 7) | MLGTD: 2835 FT 30:16:07:17Z VEL: 198 KGS HDOT: -1.5 FPS                      | M 3 EOM WEIGHT: 218159 X CG: 1080.6          | ET BR/UP 222K 1:10:08 MET           |         | VELOCITY 25785 FPS   |           | MIDDECK: 2210 LBS  | TAL WX: Zaragoza (prime), Moron, and Ben Guerir forecast and observed GO.   |
|                  |                                  | P/S 1: Roberta L. Bondar (Canada) P240/R141/F16   | TDEL: 0.00 0.562/0.6   | NLGTD: 5901 FT 30:16:07:27Z VEL: 168 KGS HDOT: -4.3 FPS                      | LANDING WEIGHT: 218089 X CG: 1082.2          | ET IMPACT LAT: 44.7°S LONG: 157.9°W |         | ENTRY RANGE 4358 NM  |           | SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 639991 LBS NON-DEPLOYED: 530075 LBS CARGO TOTAL: 1326328 LBS                          | LAKEBEDS: EDW and NOR lakebeds NO GO (WET for L&L).   |
|                  |                                  | P/S 2: Ulf D. Merbold (Germany) (Flt 2 - STS-9) P241/R29/V68/M28  | MAX QN: 692 PSF 708 PSF  | BRK INIT: 133 KGS  |  |                                     |         |                      |           | PERFORMANCE MARGINS (LBS): FPR: 4339 FUEL BIAS: 1394 FINAL TDDP: 2511 RECON: 2716  | ALT I-LOADS:<br>- Nominal selected. No uplink required.   |
|                  |                                  | MCC FCR-1 (25)  | SRB STG: 2+06.6 2+08   | AVE BRK DECEL: 6.3 FPS/S   |  |                                     |         |                      |           |  | FLIGHT DURATION CHANGE:<br>- Flight extended 1 day from 7 to 8 days to get additional Spacelab science data.  |
|                  |                                  | FLIGHT DIRECTORS: Asc/Ent - N. W. Hale Ld/O 2 - R. E. Castle O 1 - J. W. Bantle O 3 - C. W. Shaw MOD - T. W. Holloway | PERF: NOMINAL  | WHEELS STOP: 30:16:08:16Z 12676 FT   |  |                                     |         |                      |           |  | LANDING SITE CHANGE: None.  |
|                  |                                  |   | 2 ENG TAL ZZA: 2+51 2+48   | ROLLOUT: 9841 FT 59 SEC  |  |                                     |         |                      |           | PAYLOADS: PLB: INTERNATIONAL MICROGRAVITY LABORATORY MATERIALS SCIENCE AND LIFE SCIENCES EXPERIMENTS (IML-1/LM) GBA (12 GAS) | SIGNIFICANT ANOMALIES:<br>- MIDDS computer not transferring all winds data to FDCF.<br>- FC2 H <sub>2</sub> motor status/AC glitch prelaunch.<br>- MVI CB trip during pitch operations.<br>- Waste water dump rate degraded.<br>- White Sands central computer failure.<br>- WCS commode control valve linkage failure. (IFM to use vice grips to open/close.)<br>- TAGS jam/imaging failure.<br>- GAS can G-609 motorized door did not open.<br>- WCCS failures and battery shortened life<br>- RCS jet L3A fail leak (oxidizer).<br>- Crew reported plume from right pod, powered up MDM FA4 and confirmed R4U oxidizer leak.<br>- SRB - Gas path in RH & LH nozzle-to-case joint polysulfide with eroded wiper O-ring.<br>- ET - two large TPS divots on the ET intertank. |
|                  |                                  |   | NEG RETURN: 4+05 4+05  | WINDS: H 0.4 KTS R 2.0 KTS OFFICIAL: 1H, 2R                                  |  |                                     |         |                      |           | MIDDECK: GOSAMR-1 SE 83-02 SE 81-9 IPMP RME-111 UVPI   | Radiators Deployed #13  |
|                  |                                  |   | PTA (U/S 290): 5+20 5+10   | DENS ALT: 670 FT   |  |                                     |         |                      |           |  |   |
|                  |                                  |   | PTM (U/S 290): 5+52 5+42   | FLT DURATION: 8:01:14:44 193:14:44   |  |                                     |         |                      |           |  |   |
|                  |                                  |   | MECO CMD:  | S/T: 276:01:02:20  |  |                                     |         |                      |           |  |   |
|                  |                                  |   | VI: 25934 25928  | OV-103: 83:03:23:03  |  |                                     |         |                      |           |  |   |
|                  |                                  |   | OMS-2 TIG: 36+12.8 36+08   | DISTANCE: 3,349,830 sm   |  |                                     |         |                      |           |  |   |
|                  |                                  |   |  |  |  |                                     |         |                      |           | 4 CRYO TK SETS NO RMS  |   |



## Page 2-53 - STS-45


[illegible]



## Page 2-54 - STS-49

[illegible]

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                 | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.              | SRB<br>RSRM<br><br>AND<br>ET | ORBIT<br><br>INC      HA/HP   |  | FSW | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|-------------------------|---------|---|--|--|--|------------------------------|---|--|-----|---|--|
| STS-49<br><br>Continued |         | Continued. . .<br><br><u>EMU/TETHERED EVA'S:</u><br><br>EVA 1 - 5/10/92<br>SS EVA #16<br>BY EV1 & EV2<br>INTELSAT CAPTURE<br>BAR - NO GO<br>3H43M<br><br>EVA 2 - 5/11/92<br>SS EVA #17<br>UNSCHEDULED EVA #3<br>BY EV1 & EV2<br>INTELSAT CAPTURE<br>BAR - NO GO<br>5H30M<br><br>EVA3 - 5/13/92<br>SS EVA #18<br>UNSCHEDULED EVA #4<br>BY EV1, EV2 & EV4<br>INTELSAT HAND CAPTURE,<br>REPLACED UPPER STAGE<br>AND RELEASED 8H29M<br><br>EVA4 - 5/14/92<br>SS EVA #19<br>BY EV3 AND EV4<br>ASEM - 7H45M |  | Continued. . .<br><br><u>DENS ALT:</u> 4664 FT<br><br><u>FLIGHT DURATION:</u><br>8:21:17:39<br>213:17:39<br><br><u>S/T:</u> 293:20:29:35<br><br><u>OV-105 TOTAL:</u><br>8:21:17:39<br><br><u>DISTANCE:</u><br>3,969,019 sm |  |                              | STS049-91-020 1992-05-16 STS-49 crewmembers complete successful capture of the International Telecommunications Organization Satellite (INTELSAT VI) during EVA3. Left to right, Hieb/MS, Akers/MS, & Thuot/MS, on RMS, have handholds on the satellite and prepare to attach capture bar (tethered to Hieb). Two earlier grapple attempts on two-person EVA's were unsuccessful. |  |     | Continued. . .<br><br><u>RECORDS:</u><br>- Longest ever EVA (8H29M), second longest EVA (7H45M).<br>- Longest EVA by female astronaut (7H45M).<br>- Four EVA's on one flight.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Av Bay 3 high delta pressure.<br>- O2 manifold valve 1 failed open (failed to close)<br>- TDRSS state vector propagation errors in MCC.<br>- Orbit Target Terminal Initiation Computation failure on third rendezvous (used D/L state vectors in Ground Computations).<br>- WCS fan sep 1 failure.<br>- Four floodlights failed.<br>- RCS jet L4L fail leak.<br>- Ku-band beta gimbal failure - IFM EVA stow of antenna similar to STS 41-G.<br>- PLBD port aft bulkhead latch failed to reach latch position.<br>- SSME 2 HPFT TD temp sensor failed offscale high.<br>- GPC AP101S microcode error. |  |



S92-36605 1992-05-20 STS-49 Orbit Team 1 (O1) poses in JSC FCR with O1 Lead FD Al Pennington (left of model of James Cook's ship Endeavour) and CAPCOM, John Casper (right of model).



S93-36604 1993-06-18 Orbit 2 (O2) Flight Control Team in JSC FCR poses with O2 FD Philip Engelauf (center front, right of Endeavour model).



S92-36606 1992-05-20 Milt Heflin/FD (front right next to ship model) with STS-49 Planning Team in JSC Flight Control Room.





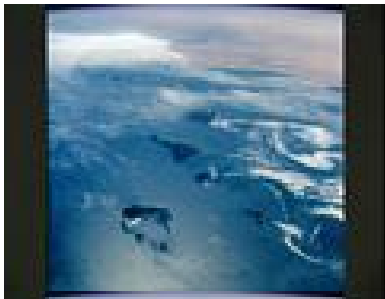
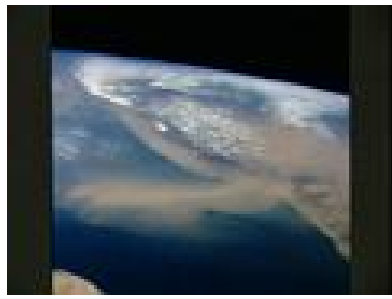




## Page 2-56 - STS-50

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY


Page 2-57 - STS-50

| FLT NO.  | ORBITER   | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES                              | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM AND ET   | ORBIT<br>INC HA/HP   |  | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|--|--|---|--|---|--|--|--|--|---|
| STS-50<br>Continued  |  | STS050-291-027 1992-07-09<br>Dunbar/MS/PYLD CDR (rt) and DeLucas/PS in SL with Lower Body Negative Pressure Study. |  | Continued. . .<br><u>DENS ALT:</u> 1423 FT<br><br><u>FLT DURATION:</u><br>13:19:30:04<br>331:30:04<br><br><u>S/T:</u> 307:15:59:29<br><br><u>OV-102:</u><br>88:20:44:28<br><br><u>DISTANCE:</u><br>5,758,332 sm |  |   |  |  |  | Continued. . .<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- RCRS shutdown due to a short in the controller, hence LiOH canisters used until IFM required use at 5 days MET.<br>- SL/Orbiter air not mixing properly. Found a removable inline redundant seal was not removed from tunnel air ducting as should be for on-orbit operations.<br>- Waste water dump line blockage causing reduction in dump rate.<br>- Cryo O <sub>2</sub> tank 2 had a 1 lb/hr leak.<br>- Cryo O <sub>2</sub> tank 2 heater A2 experienced intermittent power dropouts.<br>- Fuel cell 3 O <sub>2</sub> purge valve did not close completely. Manually closed, did not purge again for remainder of flight.<br>- Cryo O <sub>2</sub> tank 7 check valve failed in open position.<br>- SS inverter overvolt shut down when SL H <sub>2</sub> O loop was turned on.<br>- FWD starboard floodlight did not come on.<br>- R OMS yaw TVC excessive movement during ascent.<br>- Aileron trim deflected to 2.2° at M=10.1, preflight predicted was maximum of 0.80 deflection.<br>- TAGS jam on day 2, used teleprinter.<br>- Flight deck Canon A1, Mark II camcorder failure.<br>- ROB brake pressure low.<br>- APU 1 gearbox N <sub>2</sub> pressure decay/ transducer erratic.<br>- L1U jet heater fail on.<br>- F2F jet fail off. |   |
| <div>EARTH VIEWS<br/>Top Lt to Rt: Canary Islands &amp; ocean wakes (STS050-82-002) and Dust Storm, Red Sea, &amp; Saudi Arabia (STS050-85-037). Bottom Lt to Rt: Mt. Pinatubo Volcano - Post Eruption, Luzon, Philippines (STS050-52-026) and Andes Mountains, Chile and Argentina (STS50-112-060).</div> |   |  |  |   |  |   |  |  |  |  |   |
|   |   |  |  |   |  |                                      |  |  |  |  |   |
|  |   |  |  |   |  |                                      |  |  |  |  |   |
|  |   |  |  |   |  | STS050-S-106 - First flight of OV-102 with drag chute, INWS, etc. (Second flight of drag chute - deployed after NLGTD). |  |  | STS50-s-084 -- Unidentified Flight Controller hangs mission plaque in FCR.           |  |   |


# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-58 - STS-46

| FLT NO.  | ORBITER  | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET  | ORBIT  |  | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|---|--|--|---|--|--|--|---|--|---|
| STS-46<br><br>SEQ<br>FLT #49<br><br>KSC-49<br><br>PAD<br>39B-15<br>MLP-1 | OV-104<br>(Flight 12)<br>Atlantis<br><br><br>OMS PODS<br>LPO1-18<br>RPO1-18<br>FRC4-12 | CDR:<br>Loren J. Shriver<br>(Flt 3 - STS 51-C & STS-31)<br>P263/R50/V51/M46<br><br>PLT:<br>Andrew M. Allen<br>P264/R149/M133<br><br>M/S 1:<br>Claude Nicollier<br>(Switzerland)<br>P265/R150/M134<br><br>M/S 2:<br>Marsha S. Ivins<br>(Flt 2 - STS-32)<br>P266/R109/V77/F12<br><br>PYLD CDR, M/S 3:<br>Jeffrey A. Hoffman<br>(Flt 3 - STS 51-D & STS-35))<br>P267/R57/V59/M52<br><br>M/S 4:<br>Franklin R. Chang-Diaz<br>(Flt 3 - STS 61-C & STS-34)<br>P268/R89/V46/M81<br><br>P/S 1:<br>Franco Malerba<br>(Italy)<br>P269/R151/M135 | KSC 39, PAD B<br>213:13:56:48Z<br>9:56:00 AM EDT (P)<br>9:56:48 AM EDT (A)<br>Friday 8<br>7/31/92 (2)<br><br>LAUNCH WINDOW<br>2H 30M CTOB<br><br>EOM PLS: KSC<br>TAL: BYD<br>TAL WX: BEN, ROTA<br><br>SELECTED:<br>RTLS: KSC 15/C/I/N<br>TAL: BEN 36/N/N<br>AOA: EDW 22/C/I/N<br>PLS: EDW 22/C/I/N<br><br>TDEL:<br>0.0 0.332/0.36<br><br>MAX Q NAV:<br>709 PSF 718 PSF<br><br>SRB STG:<br>2:04.2 2:06<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>2:51 2:54<br><br>NEG RETURN:<br>3:59 4:02<br><br>PTA (U/S 285):<br>4:23 4:22<br><br>PTM (U/S 285):<br>5:29 5:29<br><br>MECO CMD:<br>8:29 8:29.8<br><br>VI:<br>25987 25985<br><br>OMS-2:<br>41:23.6 41:23.6<br>351.2 FPS351.4 FPS | KSC 33 (KSC 11)<br>221:13:11:50Z<br>9:11:50 AM EDT<br>Saturday 9<br>8/8/92 (4)<br><br>DEORBIT BURN:<br>221:12:17:10Z<br><br>XRANGE: 499 NM<br><br>ORBIT DIR: DL 24<br><br>AIM PT: NOMINAL<br><br>MLGTD: 1866 FT<br>221:13:11:50Z<br>VEL: 202 KGS<br>195 KEAS<br>HDOT: -1 FPS<br><br>TD NORM 195:<br>1891 FT<br><br>NLGTD: 6501 FT<br>221:13:12:05Z<br>VEL: 154 KGS<br>HDOT: -4.3 FPS<br><br>BRK INIT: 131 KGS<br><br>AVE BRK DECEL:<br>5.9 FPS/S<br><br>WHEELS STOP:<br>221:13:12:55Z<br>12726 FT<br><br>ROLLOUT:<br>10840 FT<br>55 SECS<br><br>WINDS:<br>T 0.4, L 0.9 KTS<br>OFFICIAL 3H, 1R<br><br>DENS ALT: 1834 FT<br><br>FLT DURATION:<br>7:23:15:02<br>191:15:02<br><br>S/T: 315:15:14:31<br><br>OV-104:<br>72:09:53:00<br><br>DISTANCE:<br>3,321,007 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/<br>80/67/104<br><br>ACTUAL:<br>100/104/<br>82/67/104<br><br>1 = 2032 (1)<br>2 = 2033 (1)<br>3 = 2027 (8)<br><br>M 3 EOM<br>WEIGHT:<br>209851 LBS<br>X CG:<br>1078.2<br><br>LANDING<br>WEIGHT:<br>209532 LBS<br>X CG:<br>1179.6 | BI-052<br><br>RSRM<br>25W<br><br>ET-48<br>LWT-41<br><br>ET<br>RPT<br>239K<br>1:21:02<br>MET<br><br>ET<br>BR/UP<br>217 K<br>1:21:39<br>MET<br><br>ET<br>IMPACT<br>LAT:<br>17.86°N<br>LONG:<br>153.0°W | 28.46°<br>(29)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2<br>230.4 X<br>228.3 NM<br><br>EURECA<br>DEPLOY:<br>231.3 X<br>227.8 NM<br><br>TSS DEPLOY:<br>161.0 X<br>158.5 NM<br><br>TSS DOCK:<br>161.0 X<br>157.8 NM<br><br>DEORBIT<br>121 X<br>121 NM<br><br>VELOCITY<br>25698 FPS<br><br>ENTRY<br>RANGE<br>4397 NM | OI-21<br>(3)<br><br>CARGO:<br>34060 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>28585 LBS<br><br>DEPLOYED:<br>9901 LBS<br><br>NON-DEPLOYED:<br>16094 LBS<br><br>MIDDECK:<br>1104 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>673238 LBS<br>NON-DEPLOYED:<br>598724 LBS<br>CARGO TOTAL:<br>1450620 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4671<br>FUEL BIAS: 983<br>FINAL TDDP:2825<br>RECON: 1942<br><br>PAYLOADS:<br>PLB:<br>European<br>Retrievable Carrier<br>(EURECA)<br>(Deployed)<br><br>Tethered Satellite<br>System (TSS-1)<br>(Deployed and<br>Retrieved)<br><br>EOIM-III<br>TEMP 2A-3<br>ICBC,<br>CONCAP-II<br>CONCAP-III<br>LDCE<br><br>MIDDECK:<br>PHCF<br>UVPI<br><br>4 CRYO TK SETS<br><br>RMS 27 (S.N. 201)<br>USED FOR<br>EURECA DEPLOY | KSC W/D: OPF 61, VAB 5, PAD 45=111 days<br><br>LAUNCH POSTPONEMENTS:<br>- Launch date 6/26/92 as of 6/5/91.<br>- Launch postponed to 7/2/92 because of STS-45 launch and landing delays.<br>- Launch postponed to 7/21/92 because of MOD STS-50 landing to launch 8-day constraint and range interference.<br>- Launch postponed to 7/31/92 to allow additional flightcrew and flight controller training.<br><br>LAUNCH SCRUB: None.<br><br>LAUNCH DELAYS:<br>- OM 48S delay at APU startup (approximatively L-5 minutes). Crew did not open APU #3 fuel isolation valve within GLS window. KSC cleared hold and count continued.<br><br>TAL WX:<br>- Banjul (prime) NO GO - ceiling, Ben Guerir GO (selected), Rota (2nd flight as substitute for Moron) NO GO - visibility (haze).<br><br>ASCENT I-LOADS:<br>- DOLILU I-Load uplinked to increase margin for green squatcleroid at M=1.53. Third DOLILU uplink, total uplink #10.<br><br>FLIGHT DURATION/LANDING SITE CHANGE:<br>- Extended 1 day because of TSS deploy problems.<br>- Waved off first landing opportunity at KSC because of scattered showers within 30 miles. Total extension, 1 day plus 1 rev.<br><br>FIRSTS:<br>- First flight of a deployment and retrieval of a tethered satellite.<br><br>NOTE: TSS deployed weight of 1040 lbs plus 90 lbs prop is not included in 9901 lbs deployed.<br><br>LASTS:<br>- Last flight of fleet without drag chute, INWS, and other improvements first used on STS-49. These modifications will be made before the next flight of OV-104.<br><br>THIRD SHUTTLE CREWMEMBER REPLACEMENT:<br>- Robert "Hoot" Gibson was replaced by Shriver in 1990. (Second Shuttle crewmember replacement occurred on STS-44.)<br><br>EVENTS:<br>- EURECA deploy at 1/17:10 MET.<br>- TSS deploy at 4/08:57:22 MET.<br>- TSS dock at 5/08:56:12 MET.<br><br>Continued. . . |  |   |



STS-46 Mission Patch: A circular patch featuring a rainbow, a satellite, and the names of the crew members: SHRIVER, ALLEN, IVINS, NICOLLIER, and CHANG-DIAZ.



STS-46 Crew Photo: A group photo of the STS-46 crew members, including CDR Shriver, PLT Allen, and Chang-Diaz/MS. In front (lt to rt) Nicollier/MS CSA, Hoffman/MS PLC, Ivins/MS, and Malerba/MS (Italy). Note the crew are positioned parallel to middeck floor with sleep station in background.

STS046-12-009 1992-08-08 Crew poses in middeck. In rear (lt to rt) CDR Shriver, PLT Allen, & Chang-Diaz/MS. In front (lt to rt) Nicollier/MS CSA, Hoffman/MS PLC, Ivins/MS, and Malerba/MS (Italy). Note the crew are positioned parallel to middeck floor with sleep station in background.

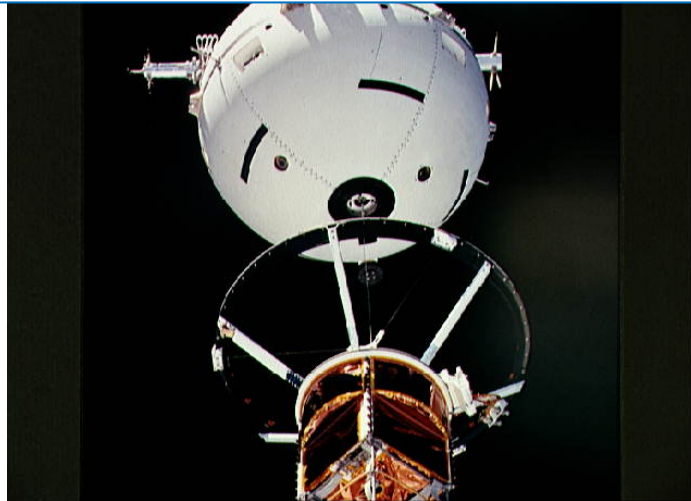


STS046-12-009 1992-08-08 Crew poses in middeck. In rear (lt to rt) CDR Shriver, PLT Allen, & Chang-Diaz/MS. In front (lt to rt) Nicollier/MS CSA, Hoffman/MS PLC, Ivins/MS, and Malerba/MS (Italy). Note the crew are positioned parallel to middeck floor with sleep station in background.



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.             | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---------------------|---------|--|---|--|--|--------------------|--------------------|--|-----|--|---|
| STS-46<br>Continued |         | At left: STS046-17-017 1992-08-08 Ivins/MS (left) and Hoffman/MS and PLC are conducting the Tether Optical Phenomena (TOP) experiment. |   |  |  |                    |                    |  |     |  | <p>Continued...</p> <p><u>SIGNIFICANT ANOMALIES:</u></p> <ul style="list-style-type: none"> <li>- MPS GH2 FCV erratic pressure.</li> <li>- Fan Sep 1 flooded, indicated stall currents and CB opened. Fan Sep 2 temporarily flooded.</li> <li>- P/L EURECA RF data handling problem (PSP lost lock due to excessive zeros in payload bit stream).</li> <li>- Flight deck speaker failed.</li> <li>- TSS U2 umbilical retractions failed when commanded by crew.</li> <li>- TSS deployer reel stalling at 179 and 251 meters.</li> <li>- TSS upper tether control mechanism jam at 224 meters.</li> <li>- Postflight investigation found the TSS level wind mechanism was jammed by a structural reinforcement bolt which was added based on late loads analysis.</li> </ul> |
|                     |         |  |   |  |  |                    |                    |  |     |  |   |
|                     |         |  |   |  |  |                    |                    |  |     |  |   |
|                     |         | STS046-102-021 1992-08-08 OV-104's RMS grapples EURECA-1L and holds it in deployment position above PLB                                |   |  |  |                    |                    |  |     |  |   |
|                     |         |  |   |  |  |                    |                    |  |     |  | <p>STS-46 Tethered Satellite System 1 (TSS-1) satellite is reeled out via its thin Kevlar tether into the blackness of space during deployment operations from Atlantis payload bay (PLB).</p>  |









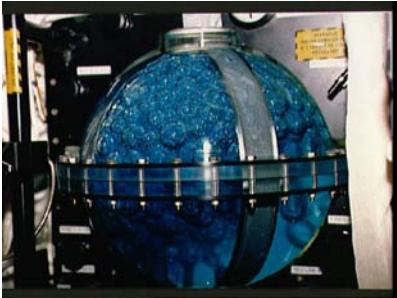
## Page 2-60 - STS-47

[illegible]

## Page 2-61 - STS-52





| FLT NO.   | ORBITER                              | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT       |   | FSW       | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--------------------------------------|--|--|--|--|---|-------------|---|-----------|---|---|
| STS-52  | OV-102 (Flight 13) Columbia          | CDR: James D. Wetherbee (Flt 2 - STS-32) P277/R108/V80/M97<br><br>PLT: Michael A. Baker (Flt 2 - STS-43) P278/R133/V81/M118<br><br>M/S 1: Charles (Lacy) Veach (Flt 2 - STS-39) P279/R127/V82/M114<br><br>M/S 2: William M. Shepherd (Flt 3 - STS-27, STS-41) P280/R96/V56/M87<br><br>M/S 3: Tamara E. Jernigan (Flt 2 - STS-40) P281/R130/V83/F14 | KSC 39, PAD B 296:17:09:38.97Z 11:16:00 AM EDT (P) 01:09:39 PM EDT (A) Thursday 13 10/22/92 (6)<br><br>LAUNCH WINDOW 2H 30M CTOB<br><br>EOM PLS: KSC TAL: BYD TAL WX: MOR, BEN<br><br>SELECTED: RTLS: KSC 15/N/N TAL: BYD 32/N/SF AOA: EDW 22/N/N PLS: EDW 04/C/I/N<br><br>TDEL: - 0.16 - 0.438/0.4<br><br>MAX Q NAV: 717 PSF 708 PSF<br><br>SRB STG: 2:03.8 2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BYD): 2:23 2:26<br><br>NEG RETURN: 4:05 4:09<br><br>PTA (U/S 235): 4:22 4:25<br><br>PTM (U/S 235): 5:08 5:09<br><br>MECO CMD: 8:29.82 8:32<br><br>VI: 25875 25874<br><br>OMS-2: 39:56 39:56 215 FPS | KSC 33 (KSC 13) 296:14:05:53Z 9:05:53 AM EST Sunday 9 11/1/92 (7)<br><br>DEORBIT BURN: 306:13:11:59Z<br><br>X RANGE: 223 NM<br><br>ORBIT DIR: DL 25<br><br>AIM PT: NOMINAL<br><br>MLGTD: 1080 FT 306:14:05:53Z VEL: 219 KGS 211 KEAS HDOT: -0.3 FPS<br><br>TD NORM 195: 2819 FT<br><br>DRAG CHUTE DEPLOY: 169 KEAS 306:14:06:06Z<br><br>NLGTD: 6949 FT 306:14:06:11Z VEL: 151 KGS HDOT: - 3.5 FPS<br><br>BRK INIT: 101 KGS<br><br>DRAG CHUTE JETTISON: 51 KGS 306:14:06:36Z<br><br>AVE BRK DECEL: 5.7 FPS/S<br><br>WHEELS STOP: 306:14:06:55Z 11788 FT<br><br>ROLLOUT: 10708 FT 63 SECS<br><br>WINDS: 1-4, R 5 KTS OFFICIAL: H3, L8<br><br>DENS ALT: 1643 FT<br><br>FLT DURATION: 9:20:56:13 236:56:13<br><br>S/I: 333:10:41:06<br><br>OV-102: 98:17:40:41<br><br>DISTANCE: 4,129,028 sm | 104/104/ 109%<br><br>PREDICTED 100/100/ 100/67/104<br><br>ACTUAL 100/100/ 95/67/104<br><br>1 = 2030 (8) 2 = 2015 (9) 3 = 2034 (1)<br><br>M 3 EOM WEIGHT: 216043 LBS X CG: 1082.6<br><br>LANDING WEIGHT: 215935 LBS X CG: 1084. | BI-055<br><br>RSRM 27K<br><br>ET-55 LWT-48<br><br>ET RPT<br><br>ET BR/UP<br><br>ET IMPACT LAT: 12.9°S LONG: 163.4°W | 28.46° (30) | DIRECT INSERTION<br><br><br><br><br><br><br><br><br><br>OMS-6: 154.2 X 114 NM 7/19:59:55<br><br>OMS-7: 114.1 X 113.9 NM 7/20:46:26<br><br>DEORBIT 113 X 110 NM<br><br>VELOCITY 25666 FPS<br><br>ENTRY RANGE 4454 NM | OI-21 (5) | CARGO: 26862 LBS<br><br>PAYLOAD CHARGEABLE: 20132 LBS<br><br>DEPLOYED: 5577 LBS<br><br>NON-DEPLOYED: 12475 LBS<br><br>MIDDECK: 2080 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 678815 LBS NON-DEPLOYED: 641377 LBS CARGO TOTAL: 1509962 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 4671 FUEL BIAS: 983 FINAL TDDP: 11107 RECON: 9801<br><br>PAYLOADS: PLB: LASER GEODYNAMICS SATELLITE (LAGEOS-II) (DEPLOYED)<br><br>CTA DEPLOYED (CANADIAN TARGET ASSY)<br><br>CANEX-2/TPCE, USMP-01 ASP<br><br>MIDDECK: PSE HPP CPCB BLOCK II SPIE CMIX CVTE CANEX | KSC W/D: OPF 72, VAB 5, PAD 27=104 days<br><br>LAUNCH POSTPONEMENTS:<br>- Launch date was 9/24/92 on 8/21/91.<br>- Launch postponed to 10/15/92 on 6/10/92.<br>- Launch postponed to 10/22/92 on 10/10/92 due to engine 3 steerhorn weld anomaly.<br><br>LAUNCH SCRUB: None.<br><br>LAUNCH DELAYS:<br>- Delayed for 1H53M39S because of RTLS crosswind exceedance (15-knot limit). A range safety warning (BLAST) existed for part of launch hold. MMT waived crosswind exceedance (0613G21 on center tower).<br><br>TAL WX:<br>- Prime TAL Banjul had reduced short range visibility but was forecast and observed GO and selected. Moron was forecast and observed NO GO because of low ceiling. Ben Guerir was NO GO during most of prelaunch period because of ceilings and threat of rain, but was observed GO when rain moved away from runway.<br><br>DOLILU/I-LOADS:<br>- Both nominal and DOLILU (Q-Alpha-4000) for aero DTO. Alternate (Q-Alpha-3250) to bailout DTO. Selected DOLILU, DOLILU uplink #4, total uplink #11).<br><br>FLIGHT DURATION CHANGE: None.<br><br>LANDING SITE CHANGE: None.<br><br>DRAG CHUTE STRATEGY:<br>- Deploy nose in air at 175 kgs/derotation if crosswinds ≤ 5 kts steady state and nose within ± 10 of center line. Dis-reef would occur at touchdown. Drag chute was deployed at 170 KGS (chute deploy #4), chute pulled left and nose went to right.<br><br>SIGNIFICANT ANOMALIES:<br>- WCS fan separator 1 failed to operate FD 10.<br>- Fuel cell 1 cell performance monitor hangup.<br>- F3L failed off (oxidizer leak).<br>- PRSD O <sub>2</sub> tank 2 heater A2 erratic.<br>- TAGS hard jam, no developer motor motion.<br>- Intermittent surface position indicator (SPI) power.<br>- S-band PM low frequency forward link loss of lock.<br>- S-band FM transmitter RF power output erratic.<br>- Window 3 internal "void" or "bruise" (R&R). |
| SEQ FLT #51   |                                      |  |  |  |  |   |             |   |           |   |   |
| KSC-51  |                                      |  |  |  |  |   |             |   |           |   |   |
| PAD 39B-17 MLP-3  | OMS PODS LPO5 - 2 RPO5 - 2 FRC2 - 13 |  |  |  |  |   |             |   |           |   |   |
|    |                                      |  |  |  |  |   |             |   |           |   |   |
| STS052-25-005 1992-11-01 In orbit crew portrait. Caption unavailable, see names above.  |                                      |  |  |  |  |   |             |   |           |   |   |
|    |                                      |  |  |  |  |   |             |   |           |   |   |
| STS052-80-024 1992-11-01 Italian Research Interim Stage (IRIS), a spinning solid fuel rocket, lifts the Laser Geodynamic Satellite II (LAGEOS II) out of its support cradle for deployment. |                                      |  |  |  |  |   |             |   |           |   |   |
| 5 CRYO TK SETS<br><br>RMS 29 (S.N. 301) USED FOR CTA DEPLOY   |                                      |  |  |  |  |   |             |   |           |   |   |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER  | CREW (5)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET  | ORBIT       |   | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|--|---|---|---|--|---|-------------|---|--------------|---|---|
| STS-53<br>SEQ FLT #52<br>KSC-52<br>PAD 39A-35 MLP-1                                | OV-103 (Flight 15)<br>Discovery<br><br>OMS PODS<br>LPO4-12<br>RPO3-16<br>FRC3-15 | CDR:<br>David M. Walker (Flt 3 - STS 51-A & STS-30)<br>P283/R48/V40/M45<br><br>PLT:<br>Robert D. Cabana (Flt 2 - STS-41)<br>P284/R113/V84/M101<br><br>M/S 1:<br>Gulon S. Bluford (Flt 4 - STS-8, STS 61-A & STS-39)<br>P285/R22/V25/M21<br><br>M/S 2:<br>James S. Voss (Flt 2 - STS-44)<br>P286/R136/V85/M121<br><br>M/S 3:<br>Michael R. Clifford P287/R157/M139 | KSC 39, PAD A<br>337:13:24:00Z<br>6:59:00 AM EST (P)<br>8:24:00 AM EST (A)<br>Wednesday 7<br>12/2/92 (3)<br><br><u>LAUNCH WINDOW</u><br>2H 30M CTOB<br><br><u>EOM PLS:</u> KSC<br><u>TAL:</u> ZZA<br><u>TAL WX:</u> MRN, BEN<br><br><u>SELECTED:</u><br><u>RTLS:</u> KSC 33/CI/N<br><u>TAL:</u> BEN 36/N/N<br><u>AOA:</u> NOR 17/N/N<br><u>PLS:</u> NOR 17/CI/N<br><br><u>TDEL:</u><br>0.32 0.722/0.766<br><br><u>MAX Q NAV:</u><br>692 PSF 705 PSF<br><br><u>SRB STG:</u><br>2:05.6 2:06<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (MRN):</u><br>2:32 2:33<br><br><u>NEG RETURN:</u><br>4:04 4:06<br><br><u>PTA (U/S 350):</u><br>4:56 4:52<br><br><u>PTM (U/S 350):</u><br>5:48 5:41<br><br><u>MECO CMD:</u><br>8:33.48 8:34<br><br><u>VI:</u><br>25885 25885<br><br><u>OMS-2:</u><br>37:03 36:53.6<br>337.3 FPS337.5 FPS | EDW 22, CONC (EDW 37, CONC 18)<br>344:20:43:47Z<br>12:43:47 PM PST<br>Wednesday 5<br>12/9/92 (6)<br><br><u>DEORBIT BURN:</u><br>344:19:43:20Z<br><br><u>XRANGE:</u> 791 NM<br><br><u>ORBIT DIR:</u> DR 8<br><br><u>AIM PT:</u> CLOSE IN<br><br><u>MLGTD:</u> 1108 FT<br>344:20:43:47Z<br><u>VEL:</u> 209 KGS<br>212 KEAS<br><u>HDOT:</u> -2.5 FPS<br><br><u>TD NORM 195:</u><br>2682 FT<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u> 167 KEAS<br>344:20:44:00Z<br><br><u>NLGTD:</u> 6329 FT<br>344:20:44:03.6Z<br><u>VEL:</u> 145 KGS<br><u>HDOT:</u> -2.2 FPS<br><br><u>BRK INIT:</u> 106 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u> 60 KGS<br>344:20:44:25Z<br><br><u>AVE BRK DECEL:</u><br>3.5 FPS/S<br><br><u>WHEELS STOP:</u><br>344:20:44:59Z<br>11273 FT<br><br><u>ROLLOUT:</u><br>10165 FT<br>82 SECS<br><br><u>WINDS:</u><br>H9, RTT<br>2614P19<br><u>OFFICIAL:</u> H15, R8<br><br><u>DENS ALT:</u> 2961 FT<br><br><u>FLT DURATION:</u><br>7:07:19:47<br>175:19:47<br><u>S/T:</u> 340:18:00:53<br><br>OV-103:<br>90:10:42:50<br><br><u>DISTANCE:</u><br>3,034,680 sm | 104/104/<br>109%<br><br><u>PREDICTED:</u><br>100/100/<br>100/70/<br>104/67<br><br><u>ACTUAL:</u><br>100/100/<br>100/73/<br>104/67<br><br>1 = 2024 (5)<br>2 = 2012 (14)<br>3 = 2017 (7)<br><br><u>M 3 EOM</u><br><br><u>WEIGHT:</u><br>194028 LBS<br><br><u>X CG:</u><br>1089.5<br><br><u>LANDING</u><br><u>WEIGHT:</u><br>193851 LBS<br><u>X CG:</u><br>1091.3<br><br><u>DEORBIT</u><br>174 X<br>169 NM<br><br><u>VELOCITY</u><br>25813 FPS<br><br><u>ENTRY</u><br><u>RANGE</u><br>4237 NM | BI-055<br><br>RSRM<br>28W<br><br>ET-49<br>LWT-42<br><br>ET<br>RPT<br><br>ET<br>BR/UP<br><br>ET<br>IMPACT<br>LAT:<br>40.95°S<br>LONG:<br>152.6°W | 57°<br>(12) | DIRECT<br>INSERTION<br><br><u>POST OMS-2</u><br>200 X<br>199 NM<br><br><u>DOD-1</u><br><u>DEPLOY:</u><br>00/05:54 MET<br>200 X<br>199 NM<br><br><u>SEP BURN:</u><br>00/06:14MET<br>204 X<br>200 NM<br><br><u>OMS-3:</u><br>01/06:19:12<br>202 X<br>175 NM<br><br><u>OMS-4:</u><br>01/07:02:03<br>176 X<br>175 NM<br>(ODERACS<br>DEPLOY ALT)<br><br><u>OMS-5:</u><br>05/05:51<br>174.9 X<br>170.3 NM<br>(2ND KSC<br>LANDING<br>EOM +1) | OI-21<br>(6) | <u>CARGO:</u><br>28316 LBS<br><br><u>PAYLOAD</u><br><u>CHARGEABLE:</u><br>26118 LBS<br><br><u>DEPLOYED:</u><br>20789 LBS<br>(NO ODERACS<br>DEPLOY)<br><br><u>NON-DEPLOYED:</u><br>4299 LBS<br>(INCLUDES<br>ODERACS)<br><br><u>MIDDECK:</u><br>1030 LBS<br><br><u>SHUTTLE</u><br><u>ACCUMULATED</u><br><u>WEIGHTS:</u><br><u>DEPLOYED:</u><br>699604 LBS<br><u>NON-DEPLOYED:</u><br>646700 LBS<br><u>CARGO TOTAL:</u><br>1538278 LBS<br><br><u>PERFORMANCE</u><br><u>MARGINS (LBS):</u><br>FPR: 3934<br>FUEL BIAS: 1055<br>FINAL TDDP:1368<br>RECON: 2844<br><br><u>PAYLOADS:</u><br><u>PLB:</u><br>DOD-1 (DPLY)<br>GCP<br>ODERACS (FAILED<br>TO DEPLOY)<br><br><u>MIDDECK:</u><br>HERCULES,<br>STL,<br>BLAST,<br>RME III,<br>CLOUDS-1A,<br>CREAM,<br>FARE<br><br>4 CRYO TK SETS<br><br>NO RMS | KSC W/D: OPF 247, VAB 5, PAD 24 = 276 days<br><br><u>LAUNCH POSTPONEMENTS:</u><br>- Launch date was 10/9/92 on 3/15/91.<br>- Launch postponed to 11/5/92 on 6/10/92 when decision made to fly STS-52 before STS-53.<br>- Postponed launch to 12/2/92 due to LP04 replacing LP01, engine steerhorn Xrays, and NWS anomaly.<br><br><u>LAUNCH SCRUB:</u> None.<br><br><u>LAUNCH DELAYS:</u><br>- Delayed 1H25M at T-9 minutes because of acreage ice on ET which ice team confirmed melted approx. 35 minutes after sunrise. Addi-tional delay caused by wing LA16 exceedance of 102% based on L-70 minutes and DOLILU I-loads.<br><br><u>TAL WX:</u><br>- Zaragoza was prime but forecast intermittent GO (ceiling and rain) but observed GO. Moron forecast NO GO - ceiling, observed marginal GO. Ben Guerir forecast and observed GO (selected).<br><br><u>DOLILU/I-LOADS:</u><br>- Nominal and DOLILU I-loads were GO on L-4.25 balloon. DOLILU was selected and uplinked. DOLILU uplink #5, total 12.<br><br><u>FLIGHT DURATION CHANGES:</u><br>- Planned extension of flight from 6 to 7 days, if launch was delayed, to provide night passes for GLO experiment.<br>- Extended one rev because forecast 3.5K broken on first KSC landing opportunity.<br><br><u>LANDING SITE CHANGES:</u><br>- Changed landing site to EDW after waving off first opportunity at KSC and forecast NO GO (ceiling on second landing opportunity at KSC).<br><br><u>FIRSTS/LASTS:</u><br>- First flight of OV-103 after OMDP-1 with drag chute, INWS, etc.<br>- Last flight from FCR-2.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- HPOT secondary seal transducer failure.<br>- Humidity separator B water deposits.<br>- Supply water dump valve water leaks.<br>- Couldn't deploy ODERACS space spheres because logic battery was discharged (160 lbs).<br>- Speedbrake FCS channel 3 position feedback anomaly.<br>- F1L jet fail leak post FRCS dump (O <sub>2</sub> leak).<br>- PPO <sub>2</sub> C transducer shift.<br>- Water spray boiler 1 steam vent heater anomalous cycles.<br><br><u>EVENTS:</u><br>- DOD-1 deployed at 00/05:54 MET.<br>- Lowered orbit to 176 nm for ODERACS deploy. |
|   |  |   | STS053-13-021 1992-12-09 In orbit crew group portrait in the aft flight deck (Caption unavailable, see names above).  |   |  |   |             |   |              |   |   |
|  |  |   | STS053-09-021 Fluid Acquisition & Resupply Equipment (FARE) middeck experiment. Photo shows the fluid mixture and transfer process in transparent sphere.   |   |  |   |             |   |              |   |   |







## Page 2-63 - STS-54

| FLT NO.   | ORBITER                           | CREW (5)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET   | ORBIT          |  | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|-----------------------------------|---|--|--|---|--|----------------|--|--------------|--|--|
|   |                                   |   |  |  |   |  | INC            | HA/HP  |              |  |  |
| <b>STS-54</b>   | OV-105<br>(Flight 3)<br>Endeavour | <u>CDR:</u><br>John H. Casper<br>(Flt 2 - STS-36)<br>P288/R111/V86/M99<br><br><u>PLT:</u><br>Donald McMonagle<br>(Flt 2 - STS-39)<br>P289/R126/V87/M113<br><br><u>M/S 1:</u><br>Gregory J. Harbaugh<br>(Flt 2 - STS-39)<br>P290/R125/V88/M112<br><br><u>M/S 2:</u><br>Mario Runco<br>(Flt 2 - STS-44)<br>P291/R137/V89/M122<br><br><u>M/S 3:</u><br>Susan J. Helms<br>P292/R158/F19<br><br><u>EMU/TETHERED EVA:</u><br>EV1 - Greg Harbaugh<br>EV2 - Mario Runco<br>1/17/93<br>4:27:50 Duration<br><br>SS EVA #20<br>REFINE TRAINING<br>METHODS FOR SPACE<br>STATION EVA'S | KSC 39, PAD B<br>13:13:59:29.95Z<br>8:52:00 AM EST (P)<br>8:59:30 AM EST (A)<br>Wednesday 8<br>1/13/93 (6)<br><br><u>LAUNCH WINDOW</u><br>2H30M, CTOB<br><br><u>EOM PLS:</u> KSC<br><u>TAL:</u> BEN<br><u>TAL ALT:</u> BYD, MRN<br><br><u>SELECTED:</u><br><u>RTLS:</u> KSC 33/N/N<br><u>TAL:</u> BEN 36/N/N<br><u>AOA:</u> NOR 17/N/N<br><u>PLS:</u> NOR 17/N/N<br><br><u>TDEL:</u><br>-0.32      0.322/0.36<br><br><u>MAX Q NAV:</u><br>709 PSF    715 PSF<br><br><u>SRB STG:</u><br>2:05.1                  2:06<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (BEN):</u><br>3:00                      3:06<br><br><u>NEG RETURN:</u><br>3:57                      4:00<br><br><u>PTA (U/S 235):</u><br>5:12                      5:14<br><br><u>PTM (U/S 235):</u><br>5:54                      5:56<br><br><u>MECO CMD:</u><br>8:28.66                  8:30.6<br><br><u>VI:</u><br>25876                      25872<br><br><u>OMS-2:</u><br>39:53                      39:53 | KSC 33 (KSC-14)<br>19:13:37:47Z<br>8:37:47 AM EST<br>Tuesday 9<br>1/19/93 (5)<br><br><u>DEORBIT BURN:</u><br>19:12:38:10Z<br><br><u>XRANGE:</u> 320 NM<br><br><u>ORBIT DIR:</u> DL 26<br><br><u>AIM PT:</u> CLOSE IN<br><br><u>MLGTD:</u> 1536 FT<br>19:13:37:47Z<br>VEL: 205 KGS<br>212 KEAS<br>HDOT: -1 FPS<br><br><u>TD NORM 195:</u><br>2710 FT<br><br><u>DRAW CHUTE</u><br><u>DEPLOY:</u> 166 KEAS<br>19:13:38:00Z<br><br><u>NLGTD:</u> 6247 FT<br>19:13:38:02Z<br>VEL: 150 KGS<br>HDOT: -3.1 FPS<br><br><u>BRK INIT:</u> 107 KGS<br><br><u>DRAW CHUTE</u><br><u>JETTISON:</u> 52 KGS<br>19:13:38:23Z<br><br><u>AVE BRK DECEL:</u><br>7.3 FPS/S<br><br><u>WHEELS STOP:</u><br>19:13:38:36Z<br>10259 FT<br><br><u>ROLLOUT:</u><br>8723 FT<br>49 SECS<br><br><u>WINDS:</u><br>4H R2<br>OFFICIAL:<br>H3, R2<br><br><u>DENS ALT:</u> -151 FT<br><br><u>FLT DURATION:</u><br>5:23:38:17<br>143:38:17<br><br><u>S/T:</u> 346:17:39:10<br><br>OV-105:<br>22:19:26:18<br><br><u>DISTANCE:</u><br>2,501,277 Sm | 104/104/<br>109%<br><br><u>PREDICTED:</u><br>100/104/<br>99/70/<br>104/67<br><br><u>ACTUAL:</u><br>100/104/<br>104/72/<br>104/67<br><br>1 = 2019(11)<br>2 = 2033 (2)<br>3 = 2018 (9)<br><br>(2018 WAS<br>REBUILT)<br><br><u>M 3 EOM</u><br><u>WEIGHT:</u><br>197481 LBS<br>X CG:<br>1091.6<br><br><u>LANDING</u><br><u>WEIGHT:</u><br>197353 LBS<br>X CG:<br>1093.4 | BI-056<br><br>RSRM<br>29W<br><br>ET-51<br>LWT-44<br><br>ET<br>RPT<br><br>ET<br>BR/UP<br><br>ET<br>IMPACT<br>LAT:<br>12.92°N<br>LONG<br>163.3°W | 28.45°<br>(31) | DIRECT<br>INSERTION<br><br><u>POST OMS-2</u><br>164 X<br>160 NM<br><br><u>SEP BURN:</u><br><u>OMS-3:</u><br>173 X<br>160 NM<br><br><u>OMS-4:</u><br>14:16:08:42Z<br>164 X<br>163 NM<br><br>MET<br>1:02:08:42<br><br><u>DEORBIT</u><br>165 X<br>159 NM<br><br><u>VELOCITY</u><br>25780 FPS<br><br><u>ENTRY</u><br><u>RANGE</u><br>4213 NM | OI-21<br>(7) | <u>CARGO:</u><br>49039 LBS<br><br><u>PAYLOAD</u><br><u>CHARGEABLE:</u><br>46540 LBS<br><br><u>DEPLOYED:</u><br>37497 LBS<br><br><u>NON-DEPLOYED:</u><br>7991 LBS<br><br><u>MIDDECK:</u><br>1052 LBS<br><br><u>SHUTTLE</u><br><u>ACCUMULATED</u><br><u>WEIGHTS:</u><br><u>DEPLOYED:</u><br>737101 LBS<br><u>NON-DEPLOYED:</u><br>655743 LBS<br><u>CARGO TOTAL:</u><br>1587317 LBS<br><br><u>PERFORMANCE</u><br><u>MARGINS (LBS):</u><br>FPR: 3934<br>FUEL BIAS: 1055<br>FINAL TDDP:2659<br>RECON: 3421<br><br><u>PAYLOADS:</u><br><u>PLB:</u><br>TDRS-F/IUS<br>(DEPLOYED)<br>DXS<br><br><u>MIDDECK:</u><br><u>CHROMEX</u><br>CGBA<br>PARE<br>SSCE<br><br>4 CRYO TK SETS<br><br>NO RMS | KSC W/D: OPF 55, VAB 6, PAD 27 = 88 days<br><br><u>LAUNCH POSTPONEMENTS:</u><br>- Baselined launch date of 11/19/92 on 4/4/91.<br>- Postponed launch date to 12/15/92 on 5/8/92.<br>- Postponed launch date to 1/13/93, after holi-days, to allow the required OPF processing time.<br><br><u>LAUNCH SCRUB:</u> None.<br><br><u>LAUNCH DELAYS:</u><br>- Delayed 7M30S while holding at T-9 minutes while discussing load indicator A16 Q-plane exceedance (101%) at M=1.55. Approved a waiver.<br><br><u>TAL WX:</u><br>- Ben Guerir and Moron forecast and observed GO. Banjul forecast and observe NO GO - VIS (haze).<br><br><u>DOLILU/I-LOADS:</u><br>- DOLILU selected and uplinked. DOLILU #6, total uplink #13.<br><br><u>FLIGHT DURATION CHANGES:</u> None.<br><br><u>FIRSTS:</u><br>- First flight with a planned fuel cell shut-down/restart. FC2 shut down for 10 hours per DTO 412 at 04/20:00<br>- First flight of EDO Waste Collection System (WCS).<br>- First Military Woman in Space - Susan J. Helms<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- EDO WCS commode, urinal, and compactor microswitch problem.<br>- PLB floodlights problems: Both mids and fwd starboard.<br>- R1R jet failed off during RCS hot fire.<br>- Rudder speedbrake secondary hydraulic switching valve indication.<br>- Hydraulic sys 3 residual pressure post APU shutdown.<br>- APU 3 overheat during ascent (WSB 3 not cooling).<br>- DOLILU GPC dump display format error.<br>- EVA - No hitch pin in PFR pip-pin.<br>- R RSRM had 18 psi chamber pressure spike at 67 seconds.<br><br><u>EVENTS:</u><br>- TDRS-F deployed at 06:12:57 MET.<br>- OMS4 to bring in additional ldg opportunities.<br>- EVA started at 03:20:50:25 MET.<br>- Deorbit burn on rev 95, landing rev 96.<br><br>NOTE: SSME 2018 was rebuilt to new engine status. |
|   |                                   |   |  |  |   |  |                |  |              |  |  |
| <b>MCC FCR-1 (32)</b><br><br><u>FLIGHT DIRECTORS:</u><br>Ascent - J. W. Bantle<br>Entry - R. D. Jackson<br>Ld/O2 - P. L. Engelauf<br>O 1 - C. W. Shaw<br>Plan - J. W. Muratore<br>MOD - A. L. Briscoe |                                   |   |  |  |   |  |                |  |              |  |  |
| <b>STS054-02-008 - In orbit crew portrait (caption not available) Susam Helms, 1st Military Woman in space, at top.</b>   |                                   |   |  |  |   |  |                |  |              |  |  |
|   |                                   |   |  |  |   |  |                |  |              |  |  |
|   |                                   |   |  |   |   |  |                |  |              |  |  |
|   |                                   |   |  |    |   |  |                |  |              |  |  |
| <b>Top: STS054-80-000U DTO 1210 EVA : Harbaugh carries Runco</b><br><b>Bottom: STS054-71-025 TDRS/IUS Deploy</b>  |                                   |   |  |  |   |  |                |  |              |  |  |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-64 - STS-56

| FLT NO.   | ORBITER  | CREW (5)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT  |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|--|--|--|--|---|--|---|--|--|---|
| STS-56<br>SEQ FLT #54<br>KSC-54<br>PAD 39B-19 MLP-1   | OV-103 (Flight 16) Discovery<br><br>Eleventh Spacelab Flight Igloo (4)<br><br>OMS PODS LPO1-19 RPO3-17 FRC3-16 | CDR:<br>Kenneth D. Cameron (Flt 2 - STS-37) P293/R121/V90/M109<br><br>PLT:<br>Stephen S. Oswald (Flt 2 - STS-42) P294/R139/V91/M124<br><br>M/S 1:<br>C. Michael Foale (Flt 2 - STS-45) P295/R143/V92/M127<br><br>M/S 2:<br>Kenneth D. Cockrell P296/R159/M140<br><br>M/S 3:<br>Ellen Ochoa P297/R160/F20<br><br>MCC FCR-1 (33)<br><br>FLIGHT DIRECTORS:<br>Ascent - J. W. Bantle<br>Entry - R. D. Jackson<br>Ld/O1 - C. W. Shaw<br>O 2 - J. W. Muratore<br>O 3 - R. E. Castle<br>MOD - A. L. Briscoe | KSC 39, PAD B<br>98:05:28:59.95Z<br>1:29:00 AM EDT (P)<br>1:29:00 AM EDT (A)<br>Thursday 14<br>4/8/93 (9)<br><br>LAUNCH WINDOW<br>Closes on ATMOS<br>Tangent Ray<br>Constraint - 2H28M<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL ALT: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 33/N/N<br>TAL: ZZA 30/C/I/N<br>AOA: NOR 17/N/N<br>PLS: EDW 22/N/N (ORBIT 7)<br>EDW 04/C/I/N (ORBIT 3)<br><br>TDEL: 0.00<br>MAX Q NAV: 675 PSF<br>SRB STG: 2:05.3<br>PERF: NOMINAL<br>2 ENG TAL (MRN): 2:24<br>NEG RETURN: 4:10<br>PTA (U/S 280): 4:22<br>PTM (U/S 280): 5:09<br>MECO CMD: 8:28.8<br>VI: 25829<br>OMS-2: 37:08<br>252 FPS | KSC 33 (KSC-15)<br>107:11:37:19Z<br>7:37:19 AM EST<br>Saturday 10<br>4/17/93 (8)<br><br>DEORBIT BURN:<br>107:10:34:25Z<br>X RANGE: 6 NM<br>ORBIT DIR: DL 27<br>AIM PT: CLOSE IN<br>MLGTD: 1074 FT<br>107:11:37:19Z<br>VEL: 196 KGS<br>206 KEAS<br>HDOT: -2.5 FPS<br>TD NORM 195: 1948 FT<br>DRAG CHUTE<br>DEPLOY: 169 KEAS<br>107:11:37:30Z<br>NLGTD: 5587 FT<br>107:11:37:34Z<br>VEL: 144 KGS<br>HDOT: -3.4 FPS<br>BRK INIT: 92 KGS<br>DRAG CHUTE<br>JETTISON: 55 KGS<br>107:11:37:59Z<br>AVE BRK DECEL: 4.9 FPS/S<br>WHEELS STOP: 107:11:38:22Z<br>10603 FT<br>ROLLOUT: 9529 FT<br>63 SECS<br>WINDS: H6, 1L<br>OFFICIAL: H6, 1L<br>DENS ALT: -74 FT<br>FLT DURATION: 9:06:08:19<br>222:08:19<br>S/T: 355:23:47:29<br>OV-103: 99:16:51:09<br>DISTANCE: 3,853,997 sm | 104/104/109%<br><br>PREDICTED: 100/100/89/67/104<br><br>ACTUAL: 100/100/89/69/104<br><br>1 = 2024 (6)<br>2 = 2033 (3)<br>3 = 2018 (10)<br><br>M 3 EOM WEIGHT: 208052 LBS<br>X CG: 1084.6<br><br>LANDING WEIGHT: 207946 LBS<br>X CG: 1086.3 | BI-058<br><br>RSRM 31KM<br><br>ET-54 LWT-47<br><br>ET RPT<br><br>ET BR/UP<br><br>ET IMPACT<br>LAT: 42.4°N<br>LONG: 154.36°W | 57° (13)<br><br>DIRECT INSERTION<br><br>POST OMS-2<br>159.8 X<br>159.1 NM<br><br>DEPLOY: 161.1 X<br>158.2 NM<br><br>RNDZ: 160.5 X<br>156.9 NM<br><br>DEORBIT<br>160 X<br>150 NM<br><br>VELOCITY<br>25797 FPS<br><br>ENTRY RANGE<br>4375 NM | OI-21 (8)<br><br>CARGO: 21000 LBS<br><br>PAYLOAD CHARGEABLE: 16439 LBS<br><br>DEPLOYED: 0 LBS<br><br>NON-DEPLOYED: 12568 LBS<br><br>MIDDECK: 1031 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 737101 LBS<br>NON-DEPLOYED: 669342 LBS<br>CARGO TOTAL: 1608317 LBS<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 3934<br>FUEL BIAS: 1055<br>FINAL TDDP: 9521<br>RECON: 10718<br><br>PAYLOADS:<br>PLB:<br>ATMOSPHERE LABORATORY FOR APPLICATIONS AND SCIENCE (ATLAS-2)<br>SSBUVA<br>SPARTAN 201 (DEPLOYED & RETRIEVED)<br>GBP<br>SUVE<br><br>MIDDECK: CMIX<br>STL<br>PARE<br>SAREX-II<br>HERCULES<br>RME-III<br>AMOS<br>CREAM<br><br>4 CRYO TK SETS<br><br>RMS 30 (S.N. 301)<br>USED FOR SPARTAN DEPLOY, CAPTURE & BERTH | KSC W/D: OPF 63, VAB 10, PAD 22 = 95 days<br><br>LAUNCH POSTPONEMENTS:<br>- Launch date of 3/23/93 was postponed to 4/6/93 because of STS-55 launch delays which were caused by SSME HPOTP tip seal retainer problems, hydraulic flex hoses, and range conflicts with Delta and Atlas launches.<br><br>LAUNCH SCRUB:<br>- Launch on 4/6/93 was scrubbed after an RSLs breakout at T-11 seconds caused by failure to get "close" indication when LH <sub>2</sub> high point bleed valve closed.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX: All three TAL sites (ZZA, MOR, and BEN) were forecast and observed GO. ZZA selected.<br><br>DOLILU/I-LOADS:<br>- Nominal I-loads were selected (were uplinked because DOLILU I-loads had been uplinked for 4/6/93 launch attempt).<br><br>NIGHT LAUNCH: Shuttle night launch #8.<br><br>FLIGHT DURATION CHANGES:<br>- Waved off two landing opportunities at KSC because of forecast low ceiling at KSC.<br>- Extended 1 day because WX forecast NO GO at KSC.<br><br>FIRSTS:<br>- First flight with 90% reefed drag chute (same deploy strategy). 90% more stable than baseline.<br>- First TV uplink to American Spacecraft via SAREX-II (UHF fast scan TV).<br><br>SIGNIFICANT ANOMALIES:<br>- RSRM 7 to 8 psi pressure spike at 74 seconds.<br>- Loose thermal blanket on aft (1307) bulkhead.<br>- FC1 O <sub>2</sub> reactant valve falsely indicated closed.<br>- FC1 substack 3 delta voltage increased during purges.<br>- ATVC Channel 4 power failure.<br>- Ku-band singed processor problem - Spacelab data exceeding 2 MPS were degraded.<br>- S-band low frequency interference problem.<br>- TAGS jam.<br>- TIPS on first flight worked OK on S-band, bad on Ku-band (TAGS master switch was turned off).<br>- L5D injector temps high indicated htr failed on.<br><br>RNDZ: Rendezvous #13 with SPARTAN for retrieval and return.<br><br>EVENTS:<br>- SAREX contact with Russian Space Station, MIR, at 2:17:55 MET.<br>- SPARTAN was deployed at 3:00:42 MET on orbit 49, grapple was at 05:01:51 MET, and berthed at 05:02:32 MET. |  |   |
|   |  |  |  |  |  |   |  |   |  |  |   |
|   |  |  |  |  |  |   |  |   |  |  |   |
| Crew inflight portrait: In front are CDR Cameron (left) and Foal/MS1. In back are (left to right) Ochoa/MS3, PLT Oswald and Cockrell/MS2. |  |  |  |  |  |   |  |   |  |  |   |
|   |  | <div><div></div><div></div></div> <div>Top: STS056-91-050 ATLAS-2 pallet in PLB<br/>Bottom: STS056-90-034 freeflying SPARTAN-2</div>  |  |  |  |   |  |   |  |  |   |



Crew inflight portrait: In front are CDR Cameron (left) and Foal/MS1. In back are (left to right) Ochoa/MS3, PLT Oswald and Cockrell/MS2.



Top: STS056-91-050 ATLAS-2 pallet in PLB  
Bottom: STS056-90-034 freeflying SPARTAN-2



## Page 2-65 - STS-55

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER   | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET  | ORBIT          |  | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---|--|---|---|--|---|----------------|--|--------------|---|--|
| STS-57<br>SEQ FLT #56<br><br>KSC-56<br><br>PAD<br>39B-20<br>MLP-2 | OV-105<br>(Flight 4)<br>Endeavour<br><br>Spacehab 1<br><br>OMS PODS<br>LPO3-15<br>RPO4-11<br>FRC5-4 | CDR:<br>Ronald J. Grabe<br>(Flt 4 - STS 51-J,<br>STS-30 & STS-42)<br>P305/R76/V41/M70<br><br>PLT:<br>Brian Duffy<br>(Flt 2 - STS-45)<br>P306/R142/V94/M126<br><br>M/S 1 (PAYLOAD CDR):<br>G. David Low<br>(Flt 3 - STS-32 & STS-43)<br>P307/R110/V64/M98<br><br>M/S 2:<br>Nancy J. Sherlock<br>P308/R165/F21<br><br>M/S 3:<br>Peter J. K. (Jeff) Wisoff<br>P309/R166/M145<br><br>M/S 4:<br>Janice E. Voss<br>P310/R167/F22<br><br>EMU/TETHERED EVA:<br>EV 1: G. David Low<br>EV 2: Jeff Wisoff<br><br>EVA 1 - 6/25/93<br>5:50 Duration | KSC 39B<br>172:13:07:21.95Z<br>9:07:00 AM EDT (P)<br>9:07:22 AM EDT (A)<br>Monday 9<br>6/21/93 (6)<br><br>LAUNCH WINDOW:<br>71M48S PLANAR/<br>PHASE WINDOW<br><br>EOM PLS: KSC<br>TAL: BYD<br>TAL WX: BEN, MRN<br><br>SELECTED:<br>RTLS: KSC15/C/I/N<br>TAL: BEN36/N/N<br>AOA: EDW22/C/I/N<br>PLS: EDW22/C/I/N<br><br>TDEL:<br>0.00 0.722/0.76<br><br>MAX Q NAV:<br>695 PSF 722 PSF<br><br>SRB STG:<br>2:04 2:06<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>2:33 2:37<br><br>NEG RETURN:<br>3:45 4:07<br><br>PTA (U/S 395):<br>4:10 4:12<br><br>PTM (U/S 427):<br>5:32 5:31<br><br>MECO CMD:<br>8:32:47 8:33<br><br>VI:<br>26028 26025<br><br>OMS-2:<br>42:11.7 42:13<br>318 FPS 316 FPS | KSC 33 (KSC 16)<br>182:12:52:16Z<br>8:52:16 AM EDT<br><br>Thursday 7<br>7/1/93 (6)<br><br>DEORBIT BURN:<br>182:11:41:42Z<br><br>X RANGE: 587 NM<br><br>ORBIT DIR: DL 29<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 2296 FT<br>182:12:52:16Z<br>VEL: 202 KGS<br>207 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 205:<br>2461 FT<br><br>DRAG CHUTE<br>DEPLOY: 175 KEAS<br>182:12:52:25Z<br><br>NLGTD: 7498 FT<br>182:12:52:34Z<br>VEL: 135 KGS<br>HDOT: -3.4 FPS<br><br>BRK INIT: 101 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>56 KGS<br>182:12:52:57Z<br><br>AVE BRK DECEL:<br>4.4 FPS/S<br><br>WHEELS STOP:<br>182:12:53:21Z<br>12251 FT<br><br>ROLLOUT:<br>9955 FT<br>65 SEC | 104/104/<br>109%<br><br>PREDICTED:<br>100/100/100/<br>67/104<br><br>ACTUAL:<br>100/100/100/<br>72/104<br><br>1 = 2019 (12)<br>2 = 2034 (2)<br>3 = 2017 (8)<br><br>M 3 EOM:<br>WEIGHT:<br>224752 LBS<br>X CG:<br>1081.1<br><br>LANDING:<br>WEIGHT:<br>224468 LBS<br>X CG:<br>1082.5 | BI-059<br><br>RSRM<br>32 KM<br><br>ET-58<br><br>LWT<br>51<br><br>ET<br>RPT<br><br>ET<br>BR/UP<br><br>ET<br>IMPACT<br>LAT:<br>16.09°N<br>LONG:<br>142.90°W | 28.45°<br>(33) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>252 X 212 NM<br><br>NC3 BURN:<br>56 FPS<br>2:04:00:35 MET<br>257/251 NM<br><br>TI BURN:<br>258 X 255 NM<br><br>ORB ADJ 3:<br>3:19:01 MET<br>256 X 209 NM<br><br>DEORBIT:<br>256 X 208 NM<br><br>VELOCITY:<br>25988 FPS<br><br>ENTRY<br>RANGE:<br>4210 NM | OI-22<br>(1) | CARGO:<br>29119 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>19630 LBS<br><br>DEPLOYED:<br>132 LBS<br><br>NON-DEPLOYED:<br>18244 LBS<br><br>MIDDECK:<br>1254 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>737233 LBS<br>NON-DEPLOYED:<br>715721 LBS<br>CARGO TOTAL:<br>1670852 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3934<br>FUEL BIAS: 1055<br>FINAL TDDP: 2030<br>RECON: 2162<br><br>PAYLOADS:<br>PLB:<br>SPACEHAB-1<br>EURECA CAPTURE<br>AND<br>RETURN<br>SHOOT, GBA,<br>CONCAP-IV<br><br>MIDDECK:<br>FARE<br>AMOS<br>SAREX-II<br><br>4 CRYO TK SETS<br><br>RMS 31<br>(S.N. 303)<br>RMS used to grapple<br>and berth EURECA<br>and EVA DTO | KSC W/D: OPF 52, VAB 16, PAD 51 = 119 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Launch date was 5/10/93 then postponed to 5/18/93.<br>- Launch date was postponed from 5/18/93 to 6/3/93 because of STS-55 and STS-56 launch delays.<br>- Launch date was postponed from 6/3/93 to 6/20/93 because SSME 3 HPOTP required changeout (QA electrochemical etch marking found in a high stress area of HPOTP turbine bearing preload spring).<br><br>LAUNCH SCRUBS:<br>- 6/20/93 launch was scrubbed during hold at T-5 minutes when 71 minute 48 second launch window expired. All three TAL sites were NO-GO (Banjul for thunderstorms and Ben Guerir and Moron for crosswind exceedences.)<br><br>LAUNCH DELAYS:<br>- Launch delayed 22 seconds because of an intruder aircraft. Countdown was at T-5 minutes awaiting a GO for RTLS weather when the aircraft entered KSC airspace (Launch danger area).<br><br>TAL WX:<br>- Banjul was forecast and observed NO GO for ceiling and rain. Ben Guerir (selected) was forecast and observed GO. Moron was forecast NO GO for ceiling, rain, and crosswinds but was observed GO.<br><br>DOLILU/I-LOADS:<br>- Nominal I-loads were GO and selected because of better Q-plane than DOLILU. No uplink required.<br><br>FLIGHT DURATION CHANGES: 3 days extension<br>- Extended 1 day for additional science.<br>- Extended 1 day because of forecast low ceiling on rev 124 and convective development and potential thunderstorms on rev 125.<br>- Extended 1 day because of forecast thunderstorms on revs 139 and 140.<br><br>FIRSTS/LASTS:<br>- Last flight of TAGS, next to last flight of teleprinter.<br>- First flight of the improved APU controller (APU #2).<br>- Last flight of drag chute without ribbons removed. (Was second flight with 90 percent reefed).<br><br>EVENTS:<br>- Started EVA at 3:23:59:51 MET (planned 4 hours). David Low pushed on EURECA antenna and ESOC commanded latches. David had to move antennas in "z" to get them latched. Both antennas confirmed latched at EVA time of 2:25, when they started the scheduled EVA DTO 1210. (EURECA deployed on STS-46<br><br>Continued. . . |

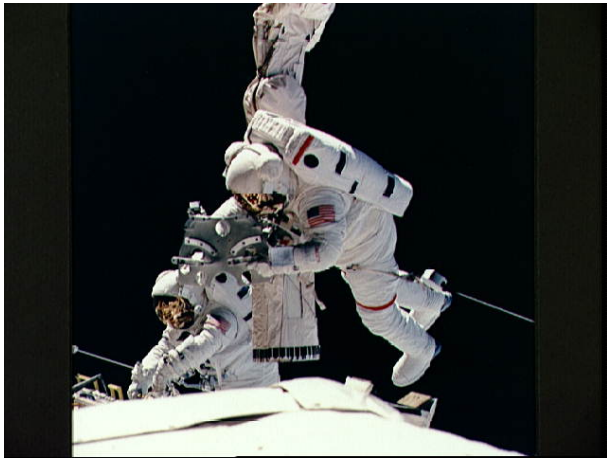






STS057-94-017 1993-07-01 Front row left to right: Wisoff/MS3, PLT Duffy, Voss/MS4. In rear (left to right): CDR Grabe, Sherlock/MS2 and Low/MS1/PLC .





Continued. . .

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.                  | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---------|--|---|--|--|--------------------------|-----------------------|--|-----|---|---|
| STS-57<br>Continued   |         | Continued. . .<br><br>SPACE SHUTTLE EVA #21<br>SCHEDULED EVA #17<br>REFINE EVA TRAINING<br>CONCEPTS AND DEMON-<br>STRATE EVA TECHNIQUES<br>FOR FUTURE EVA'S.<br><br>ADDED UNSCHEDULED<br>MANUAL LATCHING OF<br>EURECA ANTENNAS<br><br>MCC FCR-1 (35)<br><br>FLIGHT DIRECTORS:<br>A/E - J. W. Bantle<br>LD/O 1 - G. A. Pennington<br>O 2 - P. L. Engelauf<br>PLNG - R. M. Kelso<br>MOD - G. E. Coen |   | Continued. . .<br><br>WINDS:<br>H6, L2 KTS<br>OFFICIAL:<br>H10, L2<br><br>DENS ALT:<br>1571 FT<br><br>FLT DURATION:<br>9:23:44:54<br>239:44:54<br><br>S/T: 375:23:12:22<br><br>OV-105:<br>32:19:11:12<br><br>DISTANCE:<br>4,118,037 sm |  |                          |                       |  |     |   | Continued. . .<br><br>RENDEZVOUS #14:<br>- Rendezvous with EURECA for capture, retrieval, and return.<br><br>SIGNIFICANT ANOMALIES:<br>- O <sub>2</sub> manifold valve tank 1 failed to close.<br>- Fuel cell 3 H <sub>2</sub> reactant valve failed to close.<br>- PPO2 sensor B is biased low.<br>- MCA logic MCA power AC3 3-phase mid 4 CB anomaly.<br>- AC3 phase-to-phase short/Spacehab PDU fuses blown and replaced (command error).<br>- Mid starboard and aft port floodlights failure.<br>- EVA waist tether small tether hook failure.<br>- Leaking EMU 1200-series battery.<br>- RMS grapple fixture/EURECA thermal control unit switch problem (installed reversed).<br>- Jet R5D heater failed on.<br>- EURECA antennas failed to latch (crew manually latched them during planned EVA).<br>- S-band intermittent forward and return links on lower left quad antenna.<br>- Ammonia boilers failed to cool post landing. |
| <div>Earth Observations</div>   |         |  | <div>Above: STS057-97-056 1993-07-01 -- Low and Wisoff perform DTO 1210 EVA in OV-105's payload bay .</div> |  |  |                          |                       |  |     |   |   |
| <div>ABOVE: STS057-80-09 --- Agricultural development in Rio Bermejo, Argentina.<br/>BELOW: STS057-73-075 --- Eastern Mediterranean, Nile River, Asia Minor - looking north over the Nile.</div>  |         |  |                          |  |  |                          |                       |    |     |   |   |
|   |         |  | STS057-93-052 1993-07-01 EURECA is retrieved by RMS to be stowed in PLB for return to earth.                |  |  |                          |                       | sts057-s-089 -- Post mission in the MCC are Greg Smith/FAO (Flight Activities Officer), holding mission plaque, and CAPCOM Curt Brown (right). |     |   |   |



## Page 2-68 - STS-51

| FLT NO.  | ORBITER  | CREW (5)  | LAUNCH SITE, LIFTOFF TIME,  | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG   | SRB RSRM  | ORBIT          |  | FSW          | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|--|---|---|--|---|---|----------------|--|--------------|--|---|
|  |  | TITLE, NAMES & EVA'S  | LANDING SITES, ABORT TIMES  | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N.  | AND ET  | INC            | HA/HP  |              |  |   |
| STS-51<br>SEQ FLT #57<br><br>KSC-57<br><br>PAD 39B-21<br>MLP-3                     | OV-103 (Flight 17)<br>Discovery<br><br>OMS PODS<br>LPO1-20<br>RPO3-18<br>FRC3-17 | CDR:<br>Frank L. Culbertson<br>(Flt 2 - STS-38)<br>P311/R116/V95/M104<br><br>PLT:<br>William F. Readdy<br>(Flt 2 - STS-42)<br>P312/R140/V96/M125<br><br>M/S 1:<br>James H. Newman<br>P313/R168/M146<br><br>M/S 2:<br>Daniel W. Bursch<br>P314/R169/M147<br><br>M/S 3:<br>Carl E. Walz<br>P315/R170/M148 | KSC 39B<br>255:11:44:59.97Z<br>7:45:00 AM EDT (P)<br>7:45:00 AM EDT (A)<br>Sunday 7<br>9/12/93 (4)<br><br>LAUNCH WINDOW:<br>1H55M ACTS/TOS<br>RAAN ORBIT 23A<br><br>EOM PLS: KSC<br>TAL: BYD<br>TAL WX: BEN<br><br>SELECTED:<br>RTL: KSC15/C/I/N<br>TAL: BEN36/N/N<br>AOA: EDW22/C/I/N<br>PLS: EDW22/C/I/N<br><br>TDEL:<br>0.16                      0.322<br><br>MAX Q NAV:<br>700 PSF                      707 PSF<br><br>SRB STG:<br>2:04.6                      2:05.0<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>3:15                      3:12<br><br>NEG RETURN:<br>3:56                      3:59<br><br>PTA (U/S 245):<br>5:15                      5:07<br><br>PTM (U/S 245):<br>6:12                      6:06<br><br>MECO CMD:<br>8:28.15                      8:29.8<br><br>VI:<br>25873                      25874<br><br>OMS-2:<br>39:53.7                      39:53.7<br>222 FPS                      222 FPS | KSC 15 (KSC 17)<br>255:07:56:06Z<br>3:56:06 AM EDT<br><br>Wednesday 6<br>9/22/93 (6)<br><br>DEORBIT BURN:<br>265:06:55:30Z<br><br>X RANGE: 89 NM<br><br>ORBIT DIR: DL 30<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 2099 FT<br>265:07:56:06Z<br>VEL: 198 KGS<br>194 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 195:<br>2080 FT<br><br>DRAG CHUTE<br>DEPLOY: 165 KEAS<br>265:07:56:16Z<br><br>NLGTD: 6539 FT<br>265:07:56:21Z<br>VEL: 144 KGS<br>HDOT: -3.9 FPS<br><br>BRK INIT: 113 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>47 KGS<br>265:07:56:43Z<br><br>AVE BRK DECEL:<br>6.9 FPS/S<br><br>WHEELS STOP:<br>265:07:56:56Z<br>10370 FT<br><br>ROLLOUT:<br>8271 FT<br>50 SEC<br><br>WINDS:<br>T2, LT KTS<br>OFFICIAL:<br>H2, L1<br><br>DENS ALT:<br>1049 FT<br><br>FLT DURATION:<br>9:20:11:06<br>236:11:06<br><br>S/T: 385:19:23:28<br><br>OV-105:<br>T09:13:02:15<br><br>DISTANCE:<br>4,106,411 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104/<br>67/104<br><br>ACTUAL:<br>100/104/104/<br>69/104<br><br>1 = 2030 (9)<br>2 = 2033 (4)<br>3 = 2032 (2)<br><br>M 3 EOM:<br>WEIGHT:<br>207043 LBS<br>X CG:<br>1084.8<br><br>LANDING:<br>WEIGHT:<br>206932 LBS<br>X CG:<br>1086.5 | BI-060<br><br>RSRM<br>33<br><br>ET-59<br><br>LWT<br>52<br><br>ET<br>RPT<br><br>ET<br>BR/UP<br><br>ET<br>IMPACT<br>LAT:<br>12.89°N<br>LONG:<br>163.4°W | 28.45°<br>(34) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>161.1 X 160.3<br>NM<br><br>ACTS/TOS<br>DEPLOY:<br>07:58:09<br>MET (P)<br>09:28:28<br>MET (A)<br>173.5 X 160.9<br>NM<br><br>ORFEUS-<br>SPAS<br>DEPLOY:<br>1/03:21:00 MET<br>164.6 X 147.2<br>NM<br><br>ORFEUS-SPAS<br>GRAPPLE:<br>7/00:05 MET<br><br>DEORBIT:<br>166 X 141 NM<br><br>VELOCITY:<br>25794 FPS<br><br>ENTRY<br>RANGE:<br>4250 NM | OI-22<br>(2) | CARGO:<br>46685 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>42637 LBS<br><br>DEPLOYED:<br>26889 LBS<br><br>NON-DEPLOYED:<br>7305 LBS<br><br>MIDDECK:<br>1122 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>764122 LBS<br>NON-DEPLOYED:<br>724148 LBS<br>CARGO TOTAL:<br>1717537 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3934<br>FUEL BIAS: 1055<br>FINAL TDDP: 1358<br>RECON: 1273<br><br>PAYLOADS:<br>PLB:<br>ACTS/TOS<br>(DEPLOYED)<br>ORFEUS-SPAS<br>(DEPLOYED AND<br>RETRIEVED)<br>LDCE (2 CANS)<br><br>MIDDECK:<br>IMAX<br>CPCG - BLOCK-II<br>CHROMEX,<br>HRSGS-A, APE-B,<br>IPMP, RME-III,<br>AMOS<br><br>4 CRYO TK SETS<br><br>RMS 32<br>(S.N. 201)<br><br>RMS USED FOR<br>SPAS DEPLOY,<br>GRAPPLE AND<br>REBERTH | KSC W/D: OPF 57, VAB 8, PAD 69 = 134 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Launch date was 2/22/93 as of 6/28/91 but was postponed to 6/30/93 on 7/32/92 to reflect changes in manifest.<br>- 6/30/93 launch was postponed to 7/13/93 on 3/31/93 based on STS-55, STS-56, and STS-57 launch delays.<br>- 7/13/93 launch was postponed to 7/17/93 because of STS-57 launch delays. (See 7/17/93 and 7/24/93 scrubs below.)<br>- 8/4/93 launch date was postponed on 7/30/93 to avoid Perseid Meteoroid (Comet Swift-Tuttle) event on 8/11/93. Launch rescheduled for 8/12/93. (See 8/12/93 scrub below.)<br>- 9/10/93 launch postponed to 9/12/93 on 9/3/93 to allow ACTS/TOS to complete a review/analysis of transisor alert (suspected as potential cause of NOAA-I and MARS Observer failures).<br><br>LAUNCH SCRUBS/PAD ABORT #4:<br>- 7/17/93 launch was scrubbed at L-31 minutes. At approximately L-2 hours, nine "B" systems PIC's indicated they were charged (four on each SRB holddown post and one on ET vent arm).<br>- 7/24/93 launch was scrubbed at T-19 seconds with an RSLs breakout caused by right SRB tilt HPU underspeed.<br>- 8/12/93 launch aborted at T-3 seconds when SSME #2 (S.N. 2033) fuel flow sensor A2 miscompared with sensor A1. (Pad abort #4.)<br>Launch reset to 9/10/93. Replaced all 3 engines at pad.<br><br>TAL WX: Banjul (prime) was forecast and observed NO-GO - ceiling. Ben Guerir (selected) was forecast and observed GO.<br><br>DOLILU/I-LOADS: Both nominal and DOLILU I-loads were GO but DOLILU was selected and uplinked to provide a slight increase in performance and drainback time. DOLILU uplink #8, I-load uplink #15.<br><br>FLIGHT DURATION CHANGES:<br>- Waved off rev 142 landing at KSC because of rain within 30 nm. Extended flight 1 day minus 1 rev. (Total extension 15 revs.)<br><br>FIRSTS:<br>- First flight of drag chute with five ribbons removed.<br>- First flight with night landing at KSC.<br>- First flight with wake up music (used Heartbreak Hotel by Carl Walz) sung by a crewmember.<br>- First flight with two U.S. and two Russian EVA's at same time.<br><br>EVENTS: Fuel cell 1 shut down for 24 hours for DTO 412.<br><br>RENDEZVOUS #15:<br>- Rendezvous with ORFEUS-SPAS for grapple, berth, and return.<br><br>NIGHT LANDING: Space Shuttle #6, first night landing at KSC.<br><br>SIGNIFICANT ANOMALIES:<br>- Right SRB tilt HPU underspeed problem. (Scrub #2.)<br>- SSME #2 fuel flow sensor A2 failed low. (Scrub #3.)<br>- FA2 MDM BITE.<br>- EECOM-01 - Loose thermal blanket on aft bulkhead.<br>- PSA slider door stuck open.<br>- Thruster L3L failed off.<br>- Thruster R1R chamber pressure transducer failure (post-flight found fuel/oxidizer reaction products (FORP) in tube.)<br>- TOS SuperZip damage, both detonation cords fired simultaneously damaging 1307 bulkhead and PLB blankets.<br>- Humidity separator B water carryover. |
|    |  |   |   |  |   |   |                |  |              |  |   |
|  |  |   |   |  |   |   |                |  |              |  |   |





## Page 2-69 - STS-58

[illegible]

# SPACE SHUTTLE MISSIONS SUMMARY


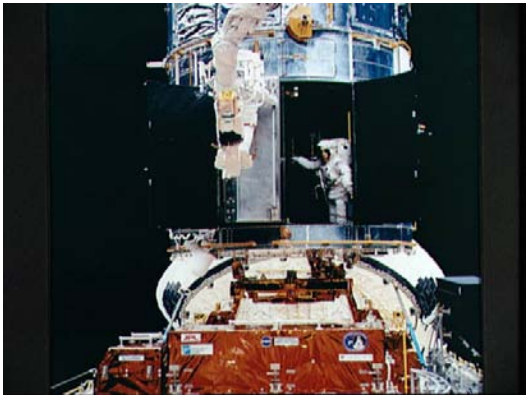

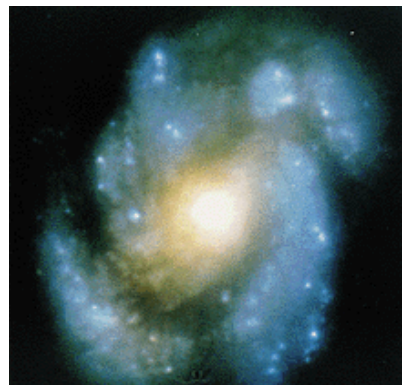
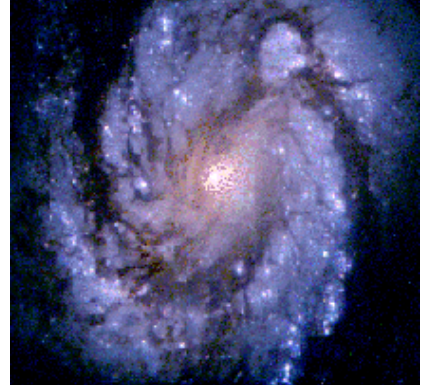
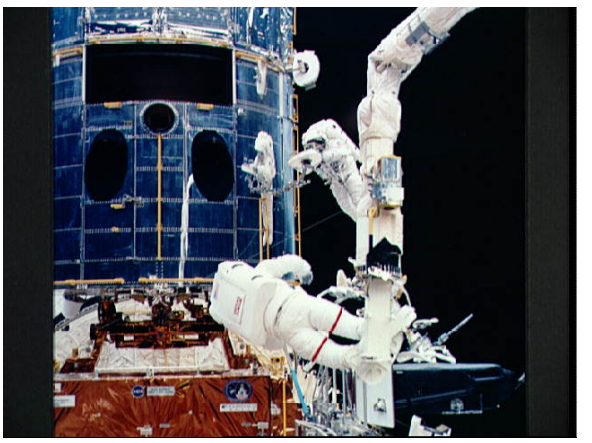
Page 2-70 - STS-61

| FLT NO.  | ORBITER   | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG  | SRB RSRM   | ORBIT   |  | FSW          | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|---|--|---|--|--|--|---|--|--------------|--|--|
| STS-61<br>SEQ FLT #59<br>KSC-59<br>PAD 39B-23<br>MLP-2                             | OV-105 (Flight 5) Endeavour<br>OMS PODS<br>LPO3-16<br>RPO4-12<br>FRC5-5 | CDR:<br>Richard O. Covey (Flt 4 - STS 51-I, STS-26 & STS-38)<br>P323/R73/V30/M67<br><br>PLT:<br>Kenneth D. Bowersox (Flt 2 - STS-50)<br>P324/R146/V97/M130<br><br>M/S 1 AND EV3:<br>Kathryn C. Thornton (Flt 3 - STS-33 & STS-49)<br>P325/R107/V73/F11<br><br>M/S 2:<br>Claude Nicollier (Flt 2 - STS-46)<br>P326/R150/V98/M134<br>Switzerland<br><br>M/S 3 AND EV 1:<br>Jeffrey A Hoffman (Flt 4 - STS 51-D, STS-35 & STS-46)<br>P327/R57/V59/M52<br><br>M/S 4, P/L CDR & EV 2:<br>F. Story Musgrave (Flt 5 - STS-6, STS 51-F, STS-33 & STS-44)<br>(P328/R15/V19/M15)<br><br>M/S 5 AND EV 4:<br>Thomas D. Akers (Flt 3 - STS-41 & STS-49)<br>P329/R115/V74/M103 | KSC 39, PAD B<br>336:09:26:59.95Z<br>4:27:00 AM EST (P)<br>4:27:00 AM EST (A)<br>Thursday 15<br>12/2/93 (4)<br><br>LAUNCH WINDOW:<br>67 MINUTES,<br>PLANAR WINDOW<br><br>EOM PLS: KSC<br>TAL: BYD<br>TAL WX: BEN,MRN<br><br>SELECTED:<br>RTLS: KSC15/N/N<br>TAL: BEN32/N/SF<br>AOA: EDW04/N/N<br>PLS: EDW04/N/N<br><br>TDEL:<br>0:32 0.402/44<br><br>MAX Q NAV:<br>701 PSF 705 PSF<br><br>SRB STG:<br>2:05.6 2:07<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BYD):<br>2:08 2:07<br><br>NEG RETURN:<br>4:04 4:07<br><br>PTA (U/S 500):<br>4:02 4:07<br><br>PTM (U/S 500):<br>5:24 5:18<br><br>MECO CMD:<br>8:32.8 8:31.9<br><br>VI:<br>26123 26115<br><br>OMS-2:<br>42:39 43:30<br>322 FPS 324 FPS<br><br>TGO:<br>3:18 3:20<br><br>Continued . . . | KSC 33 (KSC 18)<br>347:05:25:33Z<br>00:25:33 AM EST<br><br>Monday 12<br>12/13/93 (7)<br><br>DEORBIT BURN:<br>347:04:14:45Z<br><br>X RANGE: 3 NM<br><br>ORBIT DIR: AR 6<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2903 FT<br>347:05:25:33Z<br>VEL: 192 KGS<br>201 KEAS<br>HDOT: -1.7 FPS<br><br>TD NORM 195:<br>3415 FT<br><br>DRAG CHUTE<br>DEPLOY: 170 KEAS<br>347:05:25:41Z<br><br>NLGTD: 6635 FT<br>347:05:25:45Z<br>VEL: 148 KGS<br>HDOT: -3.5 FPS<br><br>BRK INIT: 118 KGS<br><br>DRAG CHUTE<br>JETTISON: 49 KTS<br>347:05:26:08Z<br><br>AVE BRK DECEL:<br>6.6 FPS/S<br><br>WHEELS STOP:<br>347:05:26:26Z<br>10825 FT<br><br>ROLLOUT:<br>7922 FT<br>53 SEC<br><br>WINDS:<br>6H, 0X KTS<br>OFFICIAL:<br>H7, L1<br><br>Continued . . . | 104/104/<br>109%<br><br>PREDICTED:<br>100/100/100/<br>74/104<br><br>ACTUAL:<br>100/100/100/<br>73/104<br><br>1 = 2019 (13)<br>2 = 2033 (5)<br>3 = 2017 (9)<br><br>M 3 EOM:<br>WEIGHT:<br>212947 LBS<br>X CG:<br>1078.9<br><br>LANDING:<br>WEIGHT:<br>212836 LBS<br>X CG:<br>1080.6<br><br>ET<br>IMPACT<br>1:29:01<br>MET<br>LAT:<br>16.4°N<br>LONG:<br>142.1°W | BI-063<br><br>RSRM<br>23<br><br>ET-60<br><br>LWT<br>53<br><br>ET<br>PRED<br>RPT<br>285 K<br><br>ET<br>BR/UP<br>214 K<br><br>ET<br>IMPACT<br>1:29:01<br>MET<br>LAT:<br>16.4°N<br>LONG:<br>142.1°W | 28.45°<br>(35)  | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>308.4 X 214.4<br>NM<br><br>RNDZ<br>BRAKING:<br>1:22:34:49 MET<br>319.6 X 313.4<br>NM<br><br>ARRAY<br>JETTISON:<br>3:19:26:00 MET<br>320.5 X 313.2<br>NM<br><br>HST<br>REBOOST:<br>6:16:59:23 MET<br>321.7 X 320.8<br>NM<br><br>DEORBIT:<br>320.4 X 319.3<br>NM<br><br>VELOCITY:<br>26096 FPS<br><br>ENTRY<br>RANGE:<br>4220 NM | OI-22<br>(4) | CARGO:<br>24363 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>17401 LBS<br><br>DEPLOYED:<br>2308 LBS<br><br>NON-DEPLOYED:<br>14428 LBS<br><br>MIDDECK:<br>665 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>766430 LBS<br>NON-DEPLOYED:<br>762368 LBS<br>CARGO TOTAL:<br>1773911 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3981<br>FUEL BIAS: 987<br>FINAL TDDP: 927<br>RECON: 554<br><br>PAYLOADS:<br>PLB:<br>HUBBLE SPACE<br>TELESCOPE<br>(HST) SERVICING<br>MISSION (SM-1)<br>(REPLACEMENT<br>HARDWARE)<br>ICBC<br><br>MIDDECK:<br>IMAX<br>AMOS<br><br>5 CRYO TK SETS<br><br>RMS 33<br>(S.N. 303)<br><br>RMS USED FOR<br>HST GRAPPLE,<br>SERVICE, AND<br>DEPLOY, AND EVA<br>WORK PLATFORM | KSC W/D: OPF 103, VAB 6, PAD 33 = 142 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Launch date was 12/2/93 as of 7/17/92.<br>- Launch date was changed to 12/7/93, then 12/2/94, then 12/1/93 on 10/25/93.<br>- Moved from Pad A to Pad B to protect payload from contamination caused by Pad A sandblasting.<br><br>LAUNCH SCRUBS:<br>- 12/1/93 launch was scrubbed while holding at T-5 minutes when 67-minute window expired. Primary causes of delay were RTLS crosswind exceedence and rain within 20 nm. Other factors were BLAST, COLA, ceiling violation (6.5K broken), and intruder ship in SRB recovery area.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX:<br>- Banjul, Ben Guerir, and Moron all forecast and observed GO.<br><br>DOLILU/I-LOADS:<br>- DOLILU uplink #9, I-load uplink #15.<br><br>NIGHT LAUNCH: Shuttle night launch #9.<br><br>FLIGHT DURATION CHANGES:<br>- Shortened flight one rev because cloud cover forecast to move in at nominal landing time.<br><br>FIRSTS:<br>- First flight with four EVA crewmembers.<br>- First flight with five EVA's (alternating crew on alternating days).<br>- Minimum shuttle crossrange (3 nm).<br><br>RENDEZVOUS #16:<br>- Rendezvous with HST for grapple, berth, repair, and deploy.<br><br>NIGHT LANDING: Space Shuttle #7, second night landing at KSC.<br><br>SIGNIFICANT ANOMALIES:<br>- Aft mission timer circuit breaker popped.<br>- In-suit drink bags leaked.<br>- Large in-suit drink bags not stowed.<br>- EMU 3 intermittent loss of 298.6 receive and all hardline comm.<br>- HST power tool S.N. 1001 failed.<br>- EMU 2 failed 0.5 psi leak check.<br>- Y star tracker temporary loss.<br>- APU 2 gas generator/fuel pump heater failure.<br>- Right OMS helium tank pressure transducer P2 bias<br>- Jet L2U failed off.<br>- Loss of biomed data on EMU 2 during EVA #5.<br>- V2 solar array outer bi-stem bowed, hence jettisoned old array.<br>- Missing TPS on forward edge of RSRM RH forward center segment. |
|  |   | MCC FCR-1 (38)<br>FLIGHT DIRECTORS:<br>A/E - R. D. Jackson<br>LD/O 2-EVA - J. M. Hefflin<br>O 2-SYS - J. W. Bantle<br>O 1 - R. E. Castle<br>PLNG - J. F. Muratore<br>MOD - B. R. Stone<br><br>Continued . . .  |   |  |  |  | STS061-05-031 Crew: Lt to Rt,<br>Musgrave/MS, CDR Covey, Nicollier/MS,<br>Hoffman/MS, PLT Bowersox,<br>Thornton/MS, and Akers/MS. |  |              |    |  |





# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-71 - STS-61




| FLT NO.             | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC<br>HA/HP | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---------------------|---------|---|--|---|---|--------------------------|-----------------------|-----|--|--|
| STS-61<br>Continued |         | <p>Continued ...</p> <p>EMU/TETHERED EVA'S:<br/>EVA #1 - 12/4/93<br/>SPACE SHUTTLE EVA #23<br/>SCHEDULED EVA #19<br/>BY EV 1 &amp; EV 2<br/>REPLACED RSU'S 2 &amp; 3,<br/>ESU'S 1 &amp; 3 AND RELATED<br/>GYRO FUSE PLUGS.<br/>7H53M57S</p> <p>EVA #2 - 12/5/93<br/>SPACE SHUTTLE EVA #24<br/>SCHEDULED EVA #20<br/>BY EV 3 &amp; EV 4<br/>REPLACED BOTH SOLAR<br/>ARRAYS, OLD +V2 ARRAY<br/>JETTISONED<br/>6H35M3S</p> <p>EVA #3 - 12/6/93<br/>SPACE SHUTTLE EVA #25<br/>BY EV 1 &amp; EV 2<br/>SCHEDULED EVA #21<br/>REPLACED WIDE<br/>FIELD/PLANETARY<br/>CAMERA AND INSTALLED<br/>TWO MSS'S<br/>6H47M28S</p> <p>EVA #4 - 12/7/93<br/>SPACE SHUTTLE EVA #26<br/>BY EV 3 &amp; EV 4<br/>SCHEDULED EVA #22<br/>REPLACED HIGH SPEED<br/>PHOTOMETER WITH<br/>COSTAR AND INSTALLED<br/>NEW COPROCESSOR<br/>6H50M55S</p> <p>EVA #5 - 12/8/93<br/>SPACE SHUTTLE EVA #27<br/>BY EV 1 &amp; EV 2<br/>SCHEDULED EVA #23<br/>REPLACED SOLAR ARRAY<br/>DRIVE ELECTRONICS,<br/>GHR'S REDUNDANCY KIT,<br/>MLI CONTAMINATION KITS<br/>FOR MSS'S, AND<br/>MANUALLY OPERATED<br/>BOTH SOLAR ARRAY<br/>PRIMARY DEPLOYMENT<br/>MECHANISMS<br/>7H20M4S</p> |  | <p>Continued ...</p> <p>DENS ALT:<br/>-1039 FT</p> <p>FLT DURATION:<br/>10:19:58:33<br/>259:58:33</p> <p>S/T: 410:15:34:33</p> <p>OV-105:<br/>43:15:09:45</p> <p>DISTANCE:<br/>4,433,772 sm</p> |   |                          |                       |     |  <p>STS061-86-030 1993-12-04 Hubble Space Telescope is berthed in Endeavour's payload bay after capture.</p>   |  <p>STS061-94-050 Thornton on end of RMS (foreground) and Akers install COSTAR during EVA for HST repair.</p> |
|                     |         |   |  |   |   |                          |                       |     | <p>At right: STS061-90-028<br/>1993-12-09 After servicing, HST flies away on new "Solar Wings".</p>    |  |
|                     |         |   |  |   |   |                          |                       |     | <p>Bottom left: m100_wfpcHSTBefore,<br/>HST Galaxy photo before repairs.<br/>Bottom right: m100_smallHSTAfter,<br/>HST Galaxy photo after repairs.</p>   |  |
|                     |         |   |  |   |   |                          |                       |     |  |  <p>STS061-74-046 Hoffman on RMS and Musgrave installing Wide Field/Planetary Camera (WFPC II).</p>           |



## Page 2-72 - STS-60

| FLT NO.   | ORBITER  | CREW (6)  | LAUNCH SITE, LIFTOFF TIME,   | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG   | SRB RSRM  | ORBIT    |   | FSW       | PAYLOAD WEIGHTS,   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--|---|--|--|---|---|----------|---|-----------|--|---|
|   |  | TITLE, NAMES & EVA'S  | LANDING SITES, ABORT TIMES   | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N.  | AND ET  | INC      | HA/HP   |           | PAYLOADS/ EXPERIMENTS  |   |
| STS-60<br>SEQ FLT #60<br><br>KSC-60<br><br>PAD 39A-37 MLP-3                         | OV-103 (Flight 18) Discovery<br><br>Spacehab 2<br><br>OMS PODS LPO1-21 RPO3-19 FRC3-18 | CDR: Charles F. Bolden (Flt 4 - STS 61-C STS-31 & STS-45)) P330/R88/V52/M80<br><br>PLT: Kenneth S. Reightler (Flt 2 - STS-48) P331/R134/V99/M119<br><br>M/S 1: N. Jan Davis (Flt 2 - STS-47) P332/R153/V100/F17<br><br>M/S 2: Ronald M. Sega P333/R175/M153<br><br>M/S 3: Franklin R. Chang-Diaz (Flt 4 - STS 61-C, STS-34 & STS-46) P334/R89/V46/M81<br><br>M/S 4: Sergei Krikalev (Flt 3 SOYUZ TM-7, MIR SOYUZ TM-12/MIR) Russian Cosmonaut (P335/R176/M154<br><br>MCC FCR-1 (39)<br><br>FLIGHT DIRECTORS: A/E - J. W. Bantle LD/O 2/C. W. Shaw O 1 - G. A. Pennington PLNG - R. E. Castle MOD - G. E. Coen | KSC 39, PAD B 34:12:09:59.965Z 7:10:00 AM EST (P) 7:10:00 AM EST (A) Thursday 16 2/3/94 (3)<br><br>LAUNCH WINDOW: 2H30M CTOB<br><br>EOM PLS: KSC TAL: ZAROGOZA TAL ALT: MORON, BEN GUERIR<br><br>SELECTED: RTLS: KSC33/C/I/ N TAL: BEN36/N/N AOA: NOR17/N/N PLS: EDW04/N/N<br><br>TDEL: 0.00 0.081/0.12<br><br>MAX Q NAV: 708 PSF 717 PSF<br><br>SRB STG: 2:05.3 2:06<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN): 2:49 2:49<br><br>NEG RETURN: 4:03 4:06<br><br>PTA (U/S 350): 5:06 5:12<br><br>PTM : N/A<br><br>MECO CMD: 8:33.1 8:32.7<br><br>VI: 25924 25916<br><br>OMS-2: 42:17 42:17 268 FPS 268 FPS | KSC 15 (KSC 19) 42:19:19:22Z 2:19:22 PM EST<br><br>Friday 6 2/11/94 (2)<br><br>DEORBIT BURN: 42:18:18:45Z<br><br>XRRANGE: 376 NM<br><br>ORBIT DIR: DL 31<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2324 FT 42:19:19:22Z<br><br>VEL: 192 KGS 205 KEAS<br><br>HDOT: -2.3FPS<br><br>TD NORM 195: 3016 FT<br><br>DRAG CHUTE DEPLOY: 172 KEAS 42:19:19:32Z<br><br>NLGTD: 7522 FT 42:19:19:41Z<br><br>VEL: 118 KGS<br><br>HDOT: -4.1 FPS<br><br>BRK INIT: 97 KGS<br><br>DRAG CHUTE JETTISON: 52 KGS 42:19:19:55Z<br><br>AVE BRK DECEL: 6.2 FPS/S<br><br>WHEELS STOP: 42:19:20:13Z 10144 FT<br><br>ROLLOUT: 7820 FT 51 SEC<br><br>WINDS: HT1, R1 OFFICIAL: H20, R0<br><br>DENS ALT: 1377 FT<br><br>FLT DURATION: 8:07:09:22 199:09:22<br><br>S/T: 418:07:43:55<br><br>OV-103: 117:20:12:37<br><br>DISTANCE: 3,439,704 sm | 104/104/ 109%<br><br>PREDICTED: 100/104/104/ 70/104<br><br>ACTUAL: 100/104/104/ 70/104<br><br>1 = 2012 (15)<br>2 = 2034 (4)<br>3 = 2032 (2)<br><br>M 3 EOM: WEIGHT: 216663 LBS X CG: 1079.6<br><br>LANDING: WEIGHT: 216595 LBS X CG: 1081.3 | BI-062<br><br>RSRM 35<br><br>ET-61<br><br>LWT 54<br><br>ET PRED RPT 285 K<br><br>ET BR/UP 214 K<br><br>ET IMPACT 1:27:21 MET<br><br>LAT: 2.69°N LONG: 123.2°W | 57° (14) | DIRECT INSERTION<br><br>POST OMS-2: 191 X 189 NM<br><br>ODERACS DEPLOY: 6:02:43:24 MET<br><br>BREMSAT DEPLOY: 06:07:13:40 MET<br><br>DEORBIT: 194.4 X 189.1 NM<br><br>VELOCITY: 25858 FPS<br><br>ENTRY RANGE: 4349 NM | OI-22 (5) | CARGO: 28957 LBS<br><br>PAYLOAD CHARGEABLE: 22296 LBS<br><br>DEPLOYED: 171 LBS<br><br>NON-DEPLOYED: 21015 LBS<br><br>MIDDECK: 1110 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 766601 LBS NON-DEPLOYED: 784493 LBS CARGO TOTAL: 1802868 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3981 FUEL BIAS: 987 FINAL TDDP: 110 RECON: 306<br><br>PAYLOADS: PLB: WSF-1 SPACEHAB-2 CAPL-1 ODERACS/ BREMSAT GBA (WITH 4 GAS CANS)<br><br>MIDDECK: SAREX-II APE-B<br><br>4 CRYO TK SETS<br><br>RMS 34 (S. N. 201)<br><br>RMS used for WSF deberth but did not deploy because of WSF problems | KSC W/D: OPF 81 VAB 5, PAD 22 = 108 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- 10/31/93 launch date baselined on 7/31/92, later changed to 10/21/93 and 11/10/93.<br>- Postponed STS-60 to 1/20/94 and moved STS-61 ahead on 9/2/93 (KSC work flows would not allow two flights before holidays).<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX:<br>- Zaragoza was prime but forecast NO GO for visibility (rain/fog) and 4K ceiling; hence, Ben Guerir was selected. ZZA was observed GO.<br>Moron forecast NO GO (headwinds and ceiling), observed NO GO (headwinds).<br><br>DOLILU/I-LOADS:<br>- Both DOLILU and Nominal I-loads were GO. DOLILU was selected because they provided approx. 300 lbs performance and 1.1-minute additional hold time. DOLILU uplink #10, total I-load uplink #16.<br><br>FLIGHT DURATION CHANGES:<br>- Extended flight one orbit because KSC was forecast NO GO for ceiling and crosswinds<br><br>FIRSTS:<br>- First flight of Russian Cosmonaut on U.S. spacecraft (Krikalev's previous flights were Soyuz TM-7 and Soyuz TM-12 with more than 1 year 3 months aboard Mir.)<br><br>SIGNIFICANT ANOMALIES:<br>- Supply H2O dump valve leak (several burps after water dumps).<br>- Unable to place diffuser cap into tunnel adapter.<br>- O2 tank 2 quantity transducer erratic.<br>- ARD nominal margin showed major thrust/mass difference with on-board data.<br>- Pilot HIU failed.<br>- Both MCC DVIS CPU's (A and B) went down).<br>- Tunnel adapter stowage net, not stowed.<br>- Hassleblad shutter failed.<br>- Payload retention latch SW 2 position indicated release instead of off.<br>- Air/ground crosstalk from ICOM to A/G loop.<br>- Wakeshield horizon sensor signals bad, hence, did not deploy WSF resulting in limited scientific data.<br>- WOW WONG anomaly. |
|   |  |   |  |  |   |   |          |   |           |  |   |
|  |  |   |  |  |   |   |          |   |           |  |   |

## Page 2-73 - STS-62

| FLT NO.  | ORBITER   | CREW (5)   | LAUNCH SITE, LIFTOFF TIME,  | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG  | SRB RSRM   | ORBIT      |  | FSW          | PAYLOAD WEIGHTS,   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS,   |
|--|---|--|---|--|--|--|------------|--|--------------|--|---|
|  |   | TITLE, NAMES & EVA'S   | LANDING SITES, ABORT TIMES  | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N.   | AND ET   | INC        | HA/HP  |              | PAYLOADS/ EXPERIMENTS  | TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
| STS-62<br>SEQ FLT #61<br><br>KSC-61<br><br>PAD 39B-24<br>MLP-1   | OV-102 (Flight 16)<br>Columbia<br><br>EDO 3<br><br>OMS PODS:<br>LPO5-5<br>RPO5-5<br>FRC2-16 | CDR:<br>John H. Casper<br>(Flt 3 - STS-36 & STS-54)<br>P336/R111/V86/M99<br><br>PLT:<br>Andrew M. Allen<br>(Flt 2 - STS-46)<br>P337/R149/V101/M133<br><br>M/S 1 (PAYLOAD CDR):<br>Pierre J. Thuot<br>(Flt 3 - STS-36 & STS-49)<br>P338/R112/V72/M100<br><br>M/S 2:<br>Charles D. (Sam) Gemar<br>(Flt 3 - STS-38 & STS-48)<br>P339/R118/V67/M106<br><br>M/S 3:<br>Marsha S. Ivins<br>(Flt 3 - STS-32 & STS-46)<br>P340/R109/V77/F12<br><br>MCC FCR-1 (40)<br><br>FLIGHT DIRECTORS:<br>A/E/T 1 - N. W. Hale<br>LD/T 2 - P. L. Engelauf<br>T 3 - C. W. Shaw<br>T 4 - J. M. Hefflin<br>MOD - A. L. Briscoe | KSC 39, PAD B<br>63:13:52:59.97Z<br>8:53:00 AM EDT (P)<br>8:53:00 AM EDT (A)<br>Friday 9<br>3/4/94 (4)<br><br>LAUNCH WINDOW:<br>2H30M, CTOB<br><br>EOM PLS: KSC<br>TAL: BEN<br>TAL WX: MRN, ZZA<br><br>SELECTED:<br>RTL: KSC33/C/I/N<br>TAL: BEN36/N/N<br>AOA: KSC33/C/I/N<br>PLS: EDW04/N/N<br><br>TDEL:<br>0:00 0.162/0.20<br><br>MAX Q NAV:<br>709 -708<br><br>SRB STG:<br>2:05.4 2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>2:41 2:44<br><br>NEG RETURN:<br>4:00 4:02<br><br>PTA (U/S 250):<br>5:09 5:07<br><br>PTM (U/S 250):<br>6:03 6:02<br><br>MECO CMD:<br>8:30.3 8:30.8<br><br>VI:<br>25886 25877<br><br>OMS-2:<br>42:19.7 42:19.7<br>208 FPS 208 FPS | KSC 33 (KSC 20)<br>77:13:09:41Z<br>08:09:41 AM EST<br><br>Friday 7<br>3/18/94 (4)<br><br>DEORBIT BURN:<br>77:12:16:50Z<br>X RANGE: 116 NM<br>ORBIT DIR: DR 10<br>AIM PT: NOMINAL<br>MLGTD: 2905 FT<br>77:13:09:41Z<br>VEL: 210 KGS<br>207 KEAS<br>HDOT: -3.4 FPS<br>TD NORM 205:<br>2974 FT<br><br>DRAG CHUTE<br>DEPLOY: 166 KEAS<br>77:13:09:55Z<br>NLGTD: 8764 FT<br>77:13:10:00Z<br>VEL: 148 KGS<br>HDOT: -3.7 FPS<br><br>BRK INIT:<br>123 KGS<br>DRAG CHUTE<br>JETTISON:<br>57 KGS<br>77:13:10:22Z<br>AVE BRK DECEL:<br>7 FPS/S<br><br>WHEELS STOP:<br>77:13:10:35Z<br>13071 FT<br><br>ROLLOUT:<br>10166 FT<br>54 SEC<br><br>WINDS:<br>T4, L3 KTS<br>OFFICIAL: 1905P08<br>T4, L3<br>DENS ALT:<br>333 FT<br><br>FLT DURATION:<br>13:23:16:41<br>335:16:41<br><br>S/T:<br>432:22:00:36<br>OV-102:<br>136:16:49:53<br>DISTANCE:<br>5,820,146 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104/<br>67/104<br><br>ACTUAL:<br>100/104/104/<br>67/104<br><br>1 = 2031 (9)<br>2 = 2109 (12)<br>3 = 2029 (8)<br><br>M 3 EOM:<br>WEIGHT:<br>228360 LBS<br>X CG:<br>1082.6<br><br>LANDING:<br>WEIGHT:<br>228250 LBS<br>X CG:<br>1084.1 | BI-064<br><br>RSRM<br>36 KM<br><br>ET-62<br><br>LWT 55<br><br>ET<br>PRED<br>RPT<br>271K<br><br>ET<br>BKUP<br>214K<br><br>ET<br>IMPACT<br>1:27:04<br>MET<br>LAT:<br>8.1°N<br>LONG:<br>132.9°W | 39°<br>(3) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>163 X 161 NM<br><br>OMS-3:<br>9:17:09:39 MET<br>33.4 FPS<br>161 X 180 NM<br><br>OMS-4:<br>9:17:50:30 MET<br>37.6 FPS<br>140 X 140 NM<br><br>OMS-5:<br>11:18:15:34<br>MET<br>37.6 FPS<br>140 X 105 NM<br><br>DEORBIT:<br>138 X 105 NM<br><br>VELOCITY:<br>25708 FPS<br><br>ENTRY<br>RANGE:<br>4391 NM | OI-22<br>(6) | CARGO:<br>30016 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>19792 LBS<br><br>DEPLOYED:<br>0 LBS<br><br>NON-DEPLOYED:<br>18512 LBS<br><br>MIDDECK:<br>1280 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>766601 LBS<br>NON-DEPLOYED:<br>804285 LBS<br>CARGO TOTAL:<br>1832884 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3981<br>FUEL BIAS: 987<br>FINAL TDDP: 871<br>RECON: 1795<br><br>PAYLOADS:<br>PLB:<br>U. S. Microgravity<br>Payload (USMP-2)<br>Solidification of<br>metals and<br>semiconductors<br>dendritic growth<br>OAST-2<br>Technology<br>experiments<br>DEE<br>SSBUV/A<br>LDCE<br><br>MIDDECK:<br>APCG, PSE, CPCG,<br>CGBA, MODE,<br>AMOS, APE-B<br><br>4 CRYO TK SETS<br>+ 4 EDO<br><br>RMS 35<br>(S.N. 301)<br>RMS used for<br>DEE tests | KSC W/D: OPF 62, VAB 5, PAD 19 = 86 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- 2/8/94 launch date baselined on 10/2/92.<br>- Postponed launch to 2/24/94 on 9/2/93.<br>- Postponed launch to 3/3/94 on 10/20/93.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 3/3/94 launch at L-16 hours because excessive<br>RTLS winds were forecast.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX:<br>- Ben Guerir, Moron, and Zaragoza were forecast and observed<br>GO, Ben Guerir was prime and selected.<br><br>NOMINAL/DOLILU/I-LOADS:<br>- Nominal I-loads were NO-GO with PLB torque box indicator at<br>102 percent. DOLILU was selected and uplinked. DOLILU #11,<br>total I-load uplink #17.<br><br>FLIGHT DURATION CHANGES: None.<br><br>FIRSTS:<br>- First flight of DC vacuum cleaner.<br>- First flight of Ku-Band Comm Adapter (KCA) uplink video.<br><br>SIGNIFICANT ANOMALIES:<br>- Galley overdispensed hot water.<br>- Excessive gas bubbles in food containers.<br>- WCS Fan Sep 1 stalled and popped all three circuit breakers.<br>- Water Coolant Loop 1 accumulator quantity transducer drift.<br>- Supply Water Tank B transducer dropout.<br>- Cryo H <sub>2</sub> Tank A heater failure.<br>- Mid-port and Mid-starboard PLB floodlight failures.<br>- O <sub>2</sub> Tank 7 quantity measurement failure.<br>- TV Cameras A, D, and end effector problems.<br>- Ops Recorder poor quality data on several tracks.<br>- APU 3 high fuel pump inlet pressure (line froze).<br>- LBNP fuse blew when vacuum cleaner operated., caused by a<br>20-volt peak-to-peak ripple<br>- PDIP power failure.<br>- KCA comm link anomaly.<br><br>RADIATOR DEPLOYED #15 (PORT RADIATOR ONLY). |
| <div>  <p>STS062-81-024 Features activity with Dexterous End Effector (DEE) on RMS. Also seen are U.S. Microgravity Payload 2 (USMP) and OAST-2.</p>  </div> |   |  |   |  |  |  |            |  |              |  |   |
|  |   |  |   |  |  <p>STS062-17-025 Crew in aft flight deck:<br/>Front: CDR Casper (left), &amp; Thuot/MS.<br/>Rear: (left to right) are PLT Allen,<br/>Ivins/MS (and hair) &amp; Gemar/MS.</p>                  |  |            |  |              |  |   |

## Page 2-74 - STS-59

[illegible]



## Page 2-75 - STS-65

[illegible]

## Page 2-76 - STS-64

[illegible]






## Page 2-77 - STS-68

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-78 - STS-66

| FLT NO.  | ORBITER   | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET  | ORBIT  |  | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|--|---|---|---|--|--|--|---|--|---|
| STS-66<br>SEQ FLT #66<br>KSC-66<br>PAD 39B-26<br>MLP-3                             | OV-104 (Flight 13)<br>Atlantis<br><br>15th Spacelab Flight<br><br>OMS PODS: LPO3-17 RPO4-13 FRC4-13 | CDR: Donald R. McMonagle (Flt 3 - STS-39, STS-54) P366/R126/V87/M113<br><br>PLT: Curtis L. Brown (Flt 2 - STS-47) P367/R152/V112/M136<br><br>M/S 1 (PAYLOAD CDR): Ellen Ochoa (Flt 2 - STS-56) P368/R160/V113/F20<br><br>M/S 2: Joseph R. Tanner P369/R185/M162<br><br>M/S 3: Jean-Francois Clervoy P370/R186/M163 (ESA - France)<br><br>M/S 4: Scott E. Parazynski P371/R187/M164<br><br>MCC FCR-1 (45)<br><br>FLIGHT DIRECTORS: A/E - J. W. Bantle LD/O 2 - R. E. Castle O 1 - J. M. Hefflin O3 - P. L. Engelauf O4 - N. W. Hale MOD - A. L. Briscoe | KSC 39 PAD B 307:16:59:42.97Z 11:56:00 AM EST (P) 11:59:43 AM EST (A) Thursday 17 11/3/94 (9)<br><br>LAUNCH WINDOW: 1H02M, Crista-SPAS Beta Req ≥ 20 deg<br><br>EOM PLS: KSC TAL: ZZA TAL WX: MRN, BEN<br><br>SELECTED: RTLS: KSC 33/N/N TAL: BEN 36/N/N AOA: NONE PLS: EDW 04/N/N<br><br>TDEL: 0.19 0.552/0.59<br><br>MAX Q NAV: 688 691<br><br>SRB STG: 2:04 2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN): 2:44 2:44<br><br>NEG RETURN: 4:07 4:09<br><br>PTA (U/S 300): 4:48 4:41<br><br>PTM (U/S 215): 5:30 5:32<br><br>MECO CMD: 8:35.9 8:34.4<br><br>VI: 25832 25826<br><br>OMS-2: 36:12 36:13 265 FPS 262 FPS | EDW 22, CONC (EDW 43, CONC 24) 318:15:33:45Z 7:33:45 AM PST Monday 13 11/14/94 (9)<br><br>DEORBIT BURN: 318:14:31:05Z<br><br>XRRANGE: 745 NM<br><br>ORBIT DIR: AL 16<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3219 FT 318:15:33:45Z VEL: 195 KGS 193 KEAS HDOT: -1.3 FPS<br><br>TD NORM 195: 3032 FT<br><br>DRAG CHUTE DEPLOY: 183 KEAS 318:15:33:49Z<br><br>NLGTD: 6390 FT 318:15:33:56Z VEL: 150 KGS HDOT: -4.4 FPS<br><br>BRK INIT: 108 KGS<br><br>DRAG CHUTE JETTISON: 62 KGS 318:15:34:16Z<br><br>AVE BRK DECEL: 6.0 FPS/S<br><br>WHEELS STOP: 318:15:34:35Z 10866 FT<br><br>ROLLOUT: 7647 FT 50 SEC<br><br>WINDS: T3, R3 KTS OFFICIAL: 3064 T3, R3 KTS<br><br>DENS ALT: 645 FT<br><br>FLT DURATION: 10:22:34:02 262:34:02<br><br>S/T: 492:00:55:13<br><br>OV-105: 83:08:27:02<br><br>DISTANCE: 4,554,791 sm | 104/104/109%<br><br>PREDICTED: 100/100/100/67/104<br><br>ACTUAL: 100/100/100/68/104<br><br>1 = 2030 (10)<br>2 = 2034 (5)<br>3 = 2017 (11)<br><br>M 3 EOM: WEIGHT: 211562 LBS X CG: 1084.4<br><br>LANDING: WEIGHT: 211411 LBS X CG: 1086.1 | BI-069<br><br>RSRM 38<br><br>ET-67<br><br>LWT 60<br><br>ET RPT 271K<br><br>ET BR/UP 214K<br><br>ET IMPACT 1:14:01 MET LAT: 42.2°S LONG: 156.9°W                  | 57° (18)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 164.8 X 164.2 NM<br><br>DEPLOY (SPAS): 00/19:50:06 MET 164 X 163 NM<br><br>SPAS GRAPPLE: 08/20:05:35 MET 160 x 157 NM<br><br>SPAS BERTH: 08/23:50:19 MET<br><br>DEORBIT: 162 X 156 NM<br><br>VELOCITY: 25798 FPS<br><br>ENTRY RANGE: 4387 NM | OI-23 (3)<br><br>CARGO: 23560 LBS<br><br>PAYLOAD CHARGEABLE: 18135 LBS<br><br>DEPLOYED: 0 LBS<br><br>NON-DEPLOYED: 9901 LBS<br><br>MIDDECK: 1080 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: 766601 LBS<br><br>NON-DEPLOYED: 912210 LBS<br><br>CARGO TOTAL: 1982955 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3775 FUEL BIAS: 1136 FINAL TDDP: 3284 RECON: 3158<br><br>PAYLOADS: PLB: CRISTA/SPAS (Deploy & retrieve)) Atmospheric Science Experiments ATLAS-3 SSBV-A ESCAPE-II<br><br>MIDDECK: PARE/NIH-R PCG-TES PCG-STES SAMS, HPP STL/NIH-C<br><br>5 CRYO TK SETS<br><br>RMS 39 (S.N. 202)<br><br>RMS used for CRISTA/SPAS deploy, grapple and berth, and monitor supply and waste water dump (saw icicle form) | KSC W/D: OPF 110, VAB 6, PAD 24 = 140 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Launch baselined as 8/18/94 on 4/22/93.<br>- Postponed launch to 10/27/94 on 9/2/93.<br>- Postponed launch to 11/3/94 on 9/30/94 after STS-68 pad abort.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS:<br>- Launch delayed for 3M43S while holding at T-5 min to discuss TAL weather. ZZA and MRN were NO GO due to forecast ceiling and rain. BEN was forecast NO GO for crosswinds. Decision made to select BEN for launch because observed crosswind trend was downward (last observed at 15 knots). Waiver to flight rule 4-64 was written.)<br><br>TAL WX:<br>- ZZA (prime) was forecast NO GO for ceiling, tailwind, and light rain within 5 nm. MRN was forecast NO GO for ceiling and light rain with 5 nm. BEN (selected) was forecast NO GO for crosswinds but downward trend.<br><br>DOLILU/I-LOADS:<br>- Both DOLILU and NOMINAL I-loads were GO, NOMINAL was selected with maximum load indicator at 88 percent. No uplink required.<br><br>FLIGHT DURATION CHANGES:<br>- Decision made to not try landing at KSC on orbits 174 and 175 due to forecast of gale winds, rain, and ceiling violations caused by Tropical Storm Gordon. Landed at EDW on orbit 176. Extended flight two orbits.<br><br>LANDING SITE CHANGE: KSC to EDW<br><br>FIRSTS:<br>- First use of "R-BAR" approach for rendezvous which is required to protect Mir solar arrays on Mir rendezvous flights.<br><br>RENDEZVOUS #18: To retrieve and return CHRISTA-SPAS, which was deployed earlier in flight.<br><br>SIGNIFICANT ANOMALIES:<br>- Spacelab ERAU 20 skipped triplet.<br>- GPS 4 MMU1 BCE 18 failure.<br>- Damaged tile at overhead window (W8).<br>- FES oscillations at low heat loads.<br>- FES outlet temp sensor lag.<br>- Av Bay 2 Smoke Detector A concentration transients.<br>- Ice formation on PLBD during simultaneous supply and waste water dump on FD8 (1.5" D X 5-6' long). Canceled icicle removal with RMS when RMS wrist camera failed. At landing, ice (approx 3"x5"x3") was seen on PLBD.<br>- FES B undertemp shutdown.<br>- Fuel Cell 2 H2O through alternate path.<br>- Spacelab subsystem inverter shutdown.<br>- NSP 2 to Ku-Band Channel 1 interface failure.<br>- WSB 3 regulator pressure decay. |  |   |
|    |   |  |   |   |   |  |  |  |   |  |   |
|  |   |  |   |   |   |  |  |  |   |  |   |
| STS066-129-005 ATLAS-3 payload in the payload bay.                                 |   |  |   |   |   |  |  |  |   |  |   |
|  |   |  |   |   |   |    |  |  |   |  |   |
|  |   |  |   |   |   | STS066-56-015 Crew on Flight Deck: left to right in lower row, Tanner/MS, CDR McMonagle, Parazynski/MS, PLT Brown. Floating at top, Ochoa/PLC & Clervoy/MS(ESA). |  |  |   |  |   |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-79 - STS-63

| FLT NO.  | ORBITER  | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE  | SSME-TL NOM-ABORT EMERG   | SRB RSRM  | ORBIT   |   | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|--|--|---|---|---|---|---|---|--|---|
| STS-63<br>SEQ<br>FLT #67<br><br>KSC-67<br><br>PAD<br>39B-27<br><br>MLP-2 | OV-103<br>(Flight 20)<br>Discovery<br><br>Spacehab-3<br><br>OMS PODS:<br>LPO1-23<br>RPO3-21<br>FRC3-20 | CDR:<br>James D. Wetherbee<br>(Flt 3 - STS-32, STS-52)<br>P372/R108/V80/M97<br><br>PLT:<br>Eileen M. Collins<br>P373/R188/F24<br><br>M/S 1/EV2 (PAYLOAD CDR):<br>Bernard A. Harris<br>(Flt 2 - STS-55)<br>P374/R162/V114/M142<br><br>M/S 2/EV1:<br>C. Michael Foale<br>(Flt 3 - STS-45, STS-56)<br>P375/R143/V92/M127<br><br>M/S 3:<br>Janice E. Voss<br>(Flt 2 - STS-57)<br>P376/R167/V115/F22<br><br>M/S 4:<br>Vladimir Titov<br>(SS Flt #1)<br>(Flt 4 - SOYUZ T-8,<br>SOYUZ T-10,<br>MIR SOYUZ TM-4)<br>P377/R189/M165<br>RUSSIAN COSMONAUT<br><br>SS EVA #29<br>EMU/TETHERED EVA<br>SCHEDULED EVA #25<br>EVA DEVELOPMENT<br>FLIGHT TEST (EDFT) #1 TO<br>DEMONSTRATE EVA<br>PROCEDURES AND<br>ABILITY TO MOVE LARGE<br>OBJECTS. COLD<br>ENVIRONMENT TESTS.<br>2/9/95<br>4H38M10S DURATION | KSC 39 PAD B<br>34:05:22:03.96Z<br>00:22:04 AM EST (P)<br>00:22:04 AM EST (A)<br>Friday 13<br>2/3/95 (4)<br><br>LAUNCH WINDOW:<br>5 min Planar/Phase<br>Window for Mir<br>Rendezvous<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC33/CI/N<br>TAL: ZZA30/N/N<br>AOA: KSC33/CI/N<br>PLS: EDW04/N/N<br><br>TDEL:<br>-0.32 -0.478/0.28<br><br>MAX Q NAV:<br>716 723<br><br>SRB STG:<br>2:05.6 2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>2:25 2:22<br><br>NEG RETURN:<br>4:04 4:06<br><br>PTA (U/S 293):<br>4:28 4:24<br><br>PTM (U/S 295):<br>5:54 5:44<br><br>SE TAL (ZZA):<br>5:53 5:59<br><br>SE PTM (U/S 810):<br>6:57 6:57<br><br>MECO CMD:<br>8:30.6 8:31.9<br><br>VI:<br>25885 25892<br><br>OMS-2:<br>42:10.3<br>252.6 FPS | KSC 15 (KSC 22)<br>42:11:50:19Z<br>6:50:19 AM EST<br>Saturday 12<br>2/11/95 (3)<br><br>DEORBIT BURN:<br>42:10:44:04 Z<br><br>X RANGE: 469 NM<br><br>ORBIT DIR: DR 13<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 1261 FT<br>42:11:50:19Z<br>VEL: 206 KGS<br>212 KEAS<br>HDOT: -2.8 FPS<br><br>TD NORM 195:<br>2583 FT<br><br>DRAG CHUTE<br>DEPLOY: 185 KEAS<br>42:11:50:27Z<br><br>NLGTD: 5460 FT<br>42:11:50:33Z<br>VEL: 148 KGS<br>HDOT: -4.8 FPS<br><br>BRK INIT: 57 KGS<br><br>DRAG CHUTE<br>JETTISON: 58 KGS<br>42:11:51:05Z<br><br>AVE BRK DECEL:<br>2.9 FPS/S<br><br>WHEELS STOP:<br>42:11:51:40Z<br>12269 FT<br><br>ROLLOUT:<br>11008 FT<br>70 SEC<br><br>WINDS:<br>H5, R2 KTS<br>OFFICIAL:<br>1705P07<br>H5, R1 KTS<br><br>DENS ALT: -443 FT<br><br>FLT DURATION:<br>8:06:28:15<br>202:28:15<br><br>S/T: 500:07:23:28<br><br>OV-103: 137:01:29:49<br><br>DISTANCE:<br>2,922,000 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/97/<br>69/104<br><br>ACTUAL:<br>100/104/94/<br>69/104<br><br>1 = 2035 (1)<br>2 = 2109 (14)<br>3 = 2029 (11)<br><br>M 3 EOM:<br>WEIGHT:<br>212775 LBS<br>X CG:<br>1079.5<br><br>LANDING:<br>WEIGHT:<br>212693 LBS<br>X CG:<br>1081.2 | BI-070<br><br>RSRM<br>42<br><br>ET-68<br><br>LWT<br>61<br><br>ET<br>RPT<br>271K<br><br>ET<br>BR/UP<br>214K<br><br>ET<br>IMPACT<br>1:27:07<br>MET<br><br>LAT:<br>0.036°S<br>LONG:<br>125.6°W | 51.66°<br>(1)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>183.9 X 168.9<br>NM<br><br>MIR RNDZ:<br>Mir CPA of<br>37 feet at<br>3/13:58 MET<br>37/19:20Z<br>213.5 X 206 NM<br><br>Backaway:<br>3/14:10 MET<br><br>Flyaround<br>Initiated:<br>3/14:53 MET<br><br>Sep Burn:<br>3/15:50 MET<br><br>DEORBIT:<br>212 X 204 NM<br>VELOCITY:<br>26903 FPS<br><br>ENTRY<br>RANGE:<br>4329 NM | OI-23<br>(4)<br><br>CARGO:<br>24903 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>19051 LBS<br><br>DEPLOYED:<br>23 LBS<br><br>NON-DEPLOYED:<br>15249 LBS<br><br>MIDDECK:<br>1128 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>766624 LBS<br>NON-DEPLOYED:<br>928587 LBS<br>CARGO TOTAL:<br>2007858 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3775<br>FUEL BIAS: 1136<br>FINAL TDDP: 1830<br>RECON: 3476<br><br>PAYLOADS:<br>PLB:<br>SPACEHAB-3<br>CGP/ODERACS-2<br>(deployed)<br>SPARTAN-204<br>(deployed and<br>retrieved)<br><br>MIDDECK:<br>SSCE<br>AMOS<br><br>4 CRYO TK SETS<br><br>RMS 40<br>(S.N. 201)<br>RMS used for<br>SPARTAN deploy,<br>retrieve, and berth<br>and TCS maneu-<br>vers, water dumps<br>and EVA objectives | KSC W/D: OPF 71, VAB 5, PAD 25 = 101 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Launch date baselined as 5/19/94 on 1/19/93.<br>- Launch date postponed to 1/26/95 on 11/18/93.<br>- Launch date postponed to 2/2/95 on 3/25/94.<br><br>LAUNCH SCRUBS:<br>- 2/2/95 launch scrubbed at L-9 hours caused by IMU2 (HAINS) platform fail BITE during transition from STBY to OPERATE. Replaced IMU and rescheduled launch for 2/3/95.<br><br>LAUNCH DELAYS: None<br><br>TAL WX:<br>- ZZA (prime and selected) and BEN were forecast and observed GO. MRN was forecast and observed NO GO for visibility (fog).<br><br>DOLILU/NOMINAL I-LOADS:<br>- Both DOLILU and NOMINAL I-loads were NO GO for Q-plane exceedance with boundary violation for engine knockdown. NOMINAL I-loads were selected because exceedance point on alpha beta envelope was bounded by a wing strut indicator which had adequate margin of safety. Waiver was written.<br><br>NIGHT LAUNCH: Space Shuttle Night Launch #10.<br><br>FLIGHT DURATION CHANGES: None<br><br>FIRSTS:<br>- First flight with a female pilot.- Eileen Collins<br>- First African-American to walk in space - Bernard Harris<br><br>RENDEZVOUS #19:<br>- Rendezvous with Mir, prox ops and flyaround with closest approach of 37 feet.<br><br>RENDEZVOUS #20:<br>- Rendezvous with SPARTAN, retrieve and berth. SPARTAN was deployed earlier in flight.<br><br>EVENTS:<br>- ODERACS deployed at 00/23:35 MET.<br>- SPARTAN deployed at 4/07:05:33 MET, grapple at 6/06:11:16 MET, and berth at 6/06:48:23 MET<br><br>RADIATOR DEPLOY #16:<br>- Port radiator deployed for approx 7 hours on FD2 for SPARTAN ops (FES INHIBIT period).<br>- Bistable HPOTP on engine 2035 limited throttle bucket to 69 percent.<br><br>Continued. . . |  |   |

Continued. . .

STS063-06-018 Crew on aft flight deck: Front row (lt to rt), Harris/PLC & Foale/MS. Back row (lt to rt), Voss/MS, Titov/MS (Russia), CDR Wetherbee, & PLT Collins (first female pilot).



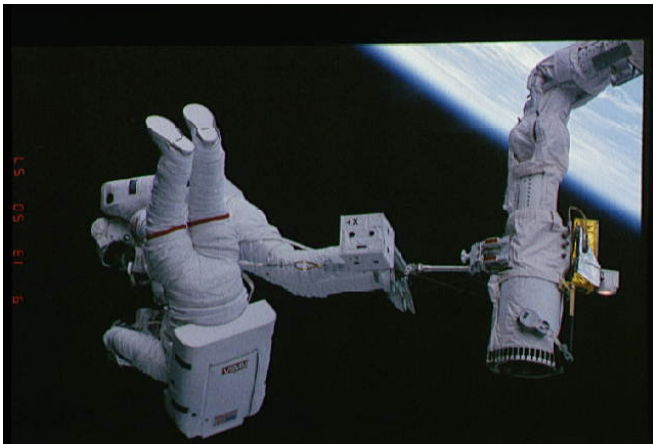




STS063-06-018 Crew on aft flight deck:  
Front row (lt to rt), Harris/PLC &  
Foale/MS. Back row (lt to rt), Voss/MS,  
Titov/MS (Russia), CDR Wetherbee, &  
PLT Collins (first female pilot).



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-80 - STS-63

| FLT NO.   | ORBITER | CREW (6)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS              | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET  | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---------|---|---|---|--|--|-------|--|-----|---|--|
| STS-63<br>Continued   |         | Continued. . .<br><br>MCC FCR-1 (46)<br><br><u>FLIGHT DIRECTORS:</u><br>A/E - N. W. Hale<br>LD/O 2 - P. L. Engelauf<br>O 1 - R. M. Kelso<br>PLNG - P. F. Dye<br>MOD - B. R. Stone |   |  |  |  |       |  |     |  | Continued. . .<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Cabin pressure transducer shifted low by 0.23 PSI.<br>- Fuel Cell 2 H <sub>2</sub> motor status increased between 0.6 volts and 0.83 volts.<br>- EV2 crewman experienced burning sensation in his eyes during repressurization at 5 PSI. Funny odor inside suit was reported.<br>- During EVA, both EV1 and EV2 electronic cuffs were partially unresponsive.<br>- THC hotstick event when aft flight controller power was turned on (ref. STS-66), several thrusters fixed.<br>- TCZ Z-axis system failure during MIR backaway at 322 feet.<br>- Erratic TCS data sporadically throughout TCS ops on SPARTAN rendezvous day.<br>- Port radiator latch 1-6 "A" latched indication intermittent.<br>- Spacehab module pressure decay (air leak into airlock).<br>- RCS jet R1U failed off (oxidizer temp dropped below RM limit of 30 degree F), oxidizer leak.<br>- RCS jet L2D failed off. Jet had good driver output with low (< 13 PSI) chamber pressure.<br>- RCS jet F1F fail leak, indicated oxidizer leak. |
|   |         |   | STS063-86-028 Collins and Titov get TIPS mail from MCC.   |   |  | STS063-716-064 Freeflying SPARTAN  |       |  |     |   |  |
|    |         |   |    |   |  |    |       |  |     |   |  |
| STS063-21-011---Harris on RMS foot restraint carries Foale during shared EVA. Harris was first African-American to walk in space. |         |   | STS063-712-057 As seen from Discovery: MIR Space Station with docked Soyuz (at bottom of MIR) and Progress at opposite end. |   |  | S95-12534 -- Pat Patnesky (left) & unidentified Russian Scientist) with Shuttle mockup in background. Pat was NASA JSC PAO photographer responsible for many, many JSC MCC mission photos. He supported all NASA manned programs from Mercury through Shuttle, retiring in 1997. |       |  |     |   |  |






## Page 2-81 - STS-67

| FLT NO.     | ORBITER                     | CREW (7)   | LAUNCH SITE, LIFTOFF TIME,   | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG                            | SRB RSRM   | ORBIT       |                       | FSW       | PAYLOAD WEIGHTS,  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|-------------|-----------------------------|--|--|--|--|--|-------------|-----------------------|-----------|---|--|
|             |                             | TITLE, NAMES & EVA'S   | LANDING SITES, ABORT TIMES   | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N.                         | AND ET   | INC         | HA/HP                 |           | PAYLOADS/ EXPERIMENTS   |  |
| STS-67      | OV-105 (Flight 8) Endeavour | CDR: Stephen S. Oswald (Flt 3 - STS-42, STS-56) P378/R139/V91/M124   | KSC 39A 61:06:38:12.95Z 01:37:00 AM EST (P) 01:38:13 AM EST (A) Thursday 18 3/2/95 (5) | EDW 22, CONC (EDW 44, CONC 25) 77:21:47:14Z 1:47:14 PM PST Saturday 13 3/18/95 (5) | 104/104/ 109%                                      | BI-071   | 28.45° (37) | DIRECT INSERTION      | 01-23 (5) | CARGO: 28528 LBS  | KSC W/D: OPF 81, VAB 5, PAD 19 = 105 days total.   |
| SEQ FLT #68 | Spacelab Pallet             | PLT: William G. Gregory P379/R190/M166   |  |  | PREDICTED: 100/104/104/ 70/104                     | RSRM 43  |             |                       |           | PAYLOAD CHARGEABLE: 20067 LBS   | LAUNCH POSTPONEMENTS:<br>- Launch date baselined as 11/3/94 on 6/24/93<br>- Postponed launch to 12/1/94 on 11/5/93<br>- Postponed launch to 1/12/95 on 3/25/94<br>- Postponed launch to 2/23/95 on 9/26/94<br>- Postponed launch to 3/2/95 on 11/30/94   |
| KSC-68      | 16th Spacelab Flight        | M/S 1: John M. Grunsfeld P380/R191/M167  | LAUNCH WINDOW: 2H30M CTOB  | DEORBIT BURN: 77:20:39:13Z   | ACTUAL: 100/104/104/ 67/104                        | ET RPT 271K                                      |             |                       |           | DEPLOYED: 0 LBS   | LAUNCH SCRUBS: None  |
| PAD 39A-41  | EDO 5                       | M/S 2: Wendy B. Lawrence P381/R192/F25   | EOM PLS: KSC TAL: BEN TAL WX: MRN  | ORBIT DIR: AL17  | SSME S/N: 1 = 2012 (16) 2 = 2033 (7) 3 = 2031 (12) | LWT 62   |             |                       |           | NON-DEPLOYED: 18303 LBS   | LAUNCH DELAYS:<br>- Delayed coming out of T-9 min hold awaiting confirmation that FES feedline B heater 1 was operating after switching from heater 2 at T-18 mins. Launch delay of 1M13S.   |
| MLP-1       |                             | M/S 3 (PAYLOAD CDR): Tamara E. Jernigan (Flt 3 - STS-40, STS-52) P382/R130/V83/F14   | SELECTED: RTLS: KSC 33/C/I/N TAL: BEN 36/C/I/N AOA: EDW 22/C/I/N PLS: EDW 22/C/I/N     | AIM PT: NOMINAL  | M 3 EOM: WEIGHT: 217646 LBS X CG: 1083.5           | ET BR/UP 214K                                    |             | DEORBIT: 193 X 182 NM |           | MIDDECK: 1764 LBS   | TAL WX:<br>- Ben Guerir (prime & selected) and Moron were forecast and observed GO. Banjul was not available because of local instability.   |
|             |                             | P/S 1: Samuel T. Durrance (Flt 2 - STS-35) P383/R120/V116/M108   | TDDEL: 0.48 0.202/0.24   | TD NORM 195: 2980 FT   | LANDING: WEIGHT: 217437 LBS X CG: 1085.0           | ET IMPACT 1:22:37 MET LAT: 15.5°S LONG: 159.45°W |             | VELOCITY: 25852 FPS   |           | SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 766624 LBS NON-DEPLOYED: 948654 LBS CARGO TOTAL: 2036386 LBS | DOLILU/NOMINAL I-LOADS:<br>- Both DOLILU and nominal were NO GO for ET load indicator ES-73 using L-1 data base. Using M data base, both were GO, DOLILU was selected because we had a better data base at MACH 1.4. An LSEAT waiver was written.  |
|             |                             | P/S 2: Ronald A. Parise (Flt 2 - STS-35) P384/R119/V117/M107   | MAX Q NAV: 728 PSF 739 PSF   | NLGTD: 6240 FT 77:21:47:14Z VEL: 151 KGS HDOT: -6.3 FPS                            |  |  |             | ENTRY RANGE: 4216 NM  |           | PERFORMANCE MARGINS (LBS): FPR: 3775 FUEL BIAS: 1136 FINAL TDDP: 4099 RECON: 6754                   | NIGHT LAUNCH: Space Shuttle night launch #11.  |
|             |                             |  | SRB STG: 2:06.9 2:05   | DRAGCHUTE DEPLOY: 147 KEAS 77:21:47:16Z  |  |  |             |                       |           | PAYLOADS: PLB: ASTRO-2 GAS-2  | FLIGHT DURATION CHANGES/LANDING SITE CHANGE:<br>- Waved off landing at KSC on orbits 246, 247, and 248 because of forecast ceiling violations and thunderstorms within 30 nm. Extended flight 1 day.<br>- Waved off landing at KSC on orbits 262 and 263. Forecast of low ceiling and 0.2 cloud cover under 12K. Decision made to change landing site to EDW.<br>- Total flight duration extension 1 day plus 1 orbit. |
|             |                             |  | PERF: NOMINAL  | BRK INIT: 142 KGS  |  |  |             |                       |           | MIDDECK: CMIX, PGS-TCS PGS-STES SAREX-2, MACE   | LANDING SITE CHANGE: KSC to EDW  |
|             |                             |  | 2 ENG TAL: 2:38 2:35   | DRAGCHUTE JETTISON: 54 KGS 77:21:47:43Z  |  |  |             |                       |           | 5 + 4 EDO CRYO TK SETS EDO PALLET   | EVENTS:<br>- Most persons in orbit at one time, total eleven (11). Mir 18 was launched at 9:11 a.m. Moscow time (12:11 a.m. CST) on March 14 from Baikonur cosmodrome with Norm Thagard, Vladimir Dezhurov and Gennady Strekalov on board (planned return on Atlantis on STS-71). Three Russians went on Mir plus 7 Americans on Endeavor).  |
|             |                             |  | NEG RETURN: 3:59 4:01  | AVE BRK DECEL: 5.5 FPS/S   |  |  |             |                       |           | RMS 41 (S.N. 303)   | Continued. . .   |
|             |                             |  | PTA (U/S 297): 4:22 4:15   | WHEELS STOP: 77:21:48Z 11647 FT  |  |  |             |                       |           | RMS NOT USED  |  |
|             |                             |  | PTM (U/S 427): 5:30 5:17   | ROLLOUT: 9935 FT 47 SEC  |  |  |             |                       |           |   |  |
|             |                             |  | SE T/M (BYD): 5:49 5:49  | WINDS: H14, R5 KTS OFFICIAL: 2515P22 H14, R4 KTS                                   |  |  |             |                       |           |   |  |
|             |                             |  | SE PTM (U/S-897): 6:33 6:33  | DENS ALT: 3481 FT  |  |  |             |                       |           |   |  |
|             |                             | MCC FCR-1 (47)   | MECO CMD: 8:27.65 8:27.3   |  |  |  |             |                       |           |   |  |
|             |                             | FLIGHT DIRECTORS:<br>A/E - R. E. Jackson<br>O 1 - B. P. Austin<br>O 2 - A. L. Pennington<br>O 3 - J. P. Shannon<br>L/O 4 - C. W. Shaw<br>MOD - A. L. Briscoe<br>MOD - J. W. Bantle | MECO VI: 25922 25914   |  |  |  |             |                       |           |   |  |
|             |                             |  | OMS-2: 40:19.8 40:19.8 279 FPS 279 FPS   |  |  |  |             |                       |           |   |  |

STS067-317-002 Crew in aft flight deck: Front (lt to rt): Jernigan/PLC, CDR Oswald, and PLT Gregory. Back (lt to rt) Lawrence/MS, Parise/PS, Durrance/PS; and Grunsfeld/MS.

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET   | ORBIT<br><br>INC<br><br>HA/HP |   | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------|--------------------------------------|---|--|---|--|-------------------------------|---|-----|--|--|
| STS-67<br><br>Continued   |         |                                      |   | Continued. . .<br><br><u>FLT DURATION:</u><br>16:15:08:48<br><br><u>S/T:</u> 516:22:32:16<br><u>OV-105:</u><br>82:17:54:11<br><br><u>DISTANCE:</u><br>6,892,836 sm     |   |  |                               |   |     |  | Continued . . .<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Spacelab SCOS cache addressing error.<br>- FES primary A failed to come out of standby.<br>- Noisy supply water tank D quantity transducer.<br>- High N <sub>2</sub> flow on PCS system 2, 14.7 cabin regulator.<br>- Middeck audio terminal unit failure (main bus current spike).<br>- CCPI failure to power portable light or camcorder.<br>- Handheld mike was inoperative on both middeck and airlock ATU's. Possible short.<br>- TEAC 8 mm VCR anomaly (degraded picture quality).<br>- Unexplained external IPS disturbances. Pointing performance degraded.<br>- Water spray boiler 2 excessive water usage (most of water was accidentally off-loaded prelaunch.)<br>- L5D oxidizer injector temperature erratic (GMEM uplinked).<br>- R4R jet fail leak, jet stopped leaking at 21:53 MET. |
|   |         |                                      |   |    |   | STS067-368-008 Oswald (center), Grunsfeld (back), and Gregory (Right) involved in Middeck Experiments. |                               |   |     |  |  |
|                                        |         |                                      |   |   |   |  |                               |   |     |  |  |
| STS067-721A-087 Flying over the “Roof of the World”, the Plateau of China. Himalayan (foreground) & Gangdise Mountains. |         |                                      |   | Sts067-s-046-- Space Shuttle Program Manager (and former Flight Director), Tommy Holloway, presents STS-67 Wall Plaque to Flight Control Team for “Mission Well Done”. |   |  |                               | sts067-s-041 -- Glynn Lunney (left), VP & Program Manager USA (and former NASA Flight Director & Shuttle Program MGR) and Flight Director Randy Stone in MCC. |     |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-83 - STS-71

| FLT NO.  | ORBITER  | CREW (10) 7 UP, 8 DOWN<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM<br>AND ET   | ORBIT<br>INC HA/HP |   | FSW          | PAYLOAD WEIGHTS,<br>PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|--|--|---|--|---|--|--------------------|---|--------------|---|--|
| STS-71<br>SEQ<br>FLT #69<br>KSC-69<br>PAD<br>39A-42<br>MLP-3 | OV-104 (Flight 14)<br>Atlantis<br>Spacelab-Mir LM-11<br>17th Spacelab Flight<br>OMS PODS:<br>LPO3-18<br>RPO4-14<br>FRC4-14 | CDR:<br>Robert L. (Hoot) Gibson<br>(Flt 5 - STS-41-B,<br>STS 61-C, STS-27,<br>STS-47)<br>P385/R30/V27/M29<br><br>PLT:<br>Charles J. Precourt<br>(Flt 2 - STS-55)<br>P386/R161/V118/M141<br><br>M/S 1 (PAYLOAD CDR):<br>Ellen S. Baker<br>(Flt 3 - STS-34, STS-50)<br>P387/R105/V75/F10<br><br>M/S 2:<br>Gregory T. Harbaugh<br>(Flt 3 - STS-39, STS-54<br>P388/R125/V88/M112<br><br>M/S 3:<br>Bonnie J. Dunbar<br>(Flt 4 - STS 61-A, STS-32,<br>STS-50)<br>P389/R79/V49/F7<br><br>MIR 19 CREW UP:<br><br>MIR-19 CDR:<br>Anatoly Y. Solovyev<br>P390/R193/M168<br><br>MIR-19 FLIGHT ENGINEER:<br>Nikolai Budarin<br>P391/R194/M169<br><br>MIR-18 CREW DOWN:<br><br>MIR-18 CDR:<br>Vladimir Dezhurov<br>P392/R195/M170 | KSC 39A<br>178:19:32:18.95Z<br>3:32:19 PM EDT (P)<br>3:32:19 PM EDT (A)<br>Tuesday 9<br>6/27/95 (7)<br><br>LAUNCH WINDOW:<br>10M19S Mir Planar/<br>Phase Window<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 33/C1/N<br>TAL: MRN 20/N/N<br>AOA: NOR 23/N/N<br>PLS: EDW 22/N/N<br><br>TDEL:<br>-0.13 0.192/0.23<br><br>MAX Q NAV:<br>708 716<br><br>SRB SEP:<br>2:03.7 1:59:10<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN):<br>2:25 2:31<br><br>NEG RETURN:<br>4:04 4:05<br><br>PTA (U/S 267):<br>4:39 4:32<br><br>DROOP (ZZA):<br>5:21 5:23<br><br>PTM:<br>6:02 5:56<br><br>SE TAL (ZZA):<br>5:58 6:07<br><br>SE PTM (U/S 784):<br>7:01 6:59 | KSC 15 (KSC 23)<br>188:14:54:35Z<br>10:54:35 AM EDT<br><br>Friday 8<br>7/7/95 (6)<br><br>DEORBIT BURN:<br>188:13:45:19Z<br><br>XRRANGE: 645 NM<br><br>ORBIT DIR: AL 18<br>AIM PT: NOMINAL<br><br>MLGTD: 2243 FT<br>188:14:54:35Z<br>VEL: 206 KGS<br>201 KEAS<br>HDOT: -1.8 FPS<br><br>TD NORM 195:<br>2575 FT<br><br>DRAG CHUTE<br>DEPLOY: 184 KEAS<br>108:14:54:39Z<br><br>NLGTD: 5471 FT<br>188:14:54:44Z<br>VEL: 166 KGS<br>HDOT: -6.0 FPS<br><br>BRK INIT: 144 KGS<br><br>DRAG CHUTE<br>JETTISON: 52 KGS<br>188:14:55:09Z<br><br>AVE BRK DECEL:<br>5.6 FPS/S<br><br>WHEELS STOP:<br>188:14:55:28Z<br>10607 FT<br><br>ROLLOUT:<br>8364 FT<br>53 SEC<br><br>WINDS:<br>T3, L5 KTS<br>OFFICIAL: 0307<br>T4, L6<br><br>DENS ALT:<br>1376 FT<br><br>FLT DURATION:<br>9:19:22:15<br><br>S/T: 526:12:54:31 | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104/<br>68/104<br><br>ACTUAL:<br>100/104/104/<br>68/104<br><br>SSME S/N:<br>1 = 2028 (10)<br>2 = 2034 (6)<br>3 = 2032 (3)<br><br>M 3 EOM:<br>WEIGHT:<br>216527 LBS<br>X CG:<br>1079.7<br><br>LANDING:<br>WEIGHT:<br>216352 LBS<br>X CG:<br>1081.3 | BI-072<br><br>RSRM<br>45<br><br>ET-70<br><br>LWT<br>63<br><br>ET<br>RPT<br>271.3K<br><br>ET<br>BR/UP<br>214K<br><br>ET<br>IMPACT<br>1:26:57<br>MET<br>LAT:<br>0.08°S<br>LONG:<br>125.4°W | 51.63°<br>(2)      | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>159.5 x 85.2<br>NM<br><br>DOCKING<br>CAPTURE:<br>1/17:27:57 MET<br><br>HARD MATE:<br>1/17:35:54 MET<br><br>SHUTTLE<br>HATCH OPEN:<br>1/19:28:56 MET<br><br>HAND SHAKE:<br>1/19:28:56 MET<br><br>SOYOZ<br>UNDOCKING:<br>6/15:32:34 MET<br><br>DEORBIT:<br>215 X 209 NM<br><br>VELOCITY:<br>25913 FPS<br><br>ENTRY<br>RANGE:<br>4321 NM | OI-24<br>(1) | CARGO:<br>26577 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>17941 LBS<br><br>DEPLOYED:<br>0 LBS<br><br>NON-DEPLOYED:<br>17251 LBS<br><br>MIDDECK:<br>690 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>766624 LBS<br>NON-DEPLOYED:<br>966595 LBS<br>CARGO TOTAL:<br>2062963 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3775<br>FUEL BIAS: 1136<br>FINAL TDDP: 1040<br>RECON: 1398<br><br>PAYLOADS:<br>PLB:<br>SHUTTLE-MIR<br>MISSION 1<br>SL-M/LM<br>ODS<br><br>MIDDECK:<br>IMAX, SAREX-II<br><br>5 CRYO TK SETS<br><br>NO RMS | KSC W/D: OPF 115, VAB 6, PAD 44 = 165 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined 5/30/95 as launch date on 10/21/93.<br>- Changed launch date to 5/24/95 on 9/1/94.<br>- Postponed launch date to NET 6/19/95 due to delays in SPECKTR launch. STS-70 was moved ahead of STS-71.<br>- Postponed launch date to NET 6/22/95 due to Mir EVA's to allow time to configure Mir docking ports and solar arrays.<br>- Postponed launch date to NET 6/23/95 (docking on FD4 would be same date as 6/24/95 launch with docking on FD3).<br><br>LAUNCH SCRUBS:<br>- Scrubbed 6/23/95 launch at T-6.25 hours when tanking window ran out. Tanking violation of lightning within 5 miles.<br>- Scrubbed 6/24/95 launch at L-44 mins while holding at T-9 minutes due to ceiling violations, rain, and thunderstorms in KSC area.<br><br>LAUNCH DELAYS: None<br><br>TAL WX:<br>- ZZA (prime) was forecast NO GO for ceiling and thunderstorms within 20 nm. MRN (selected) and BEN were both forecast and observed GO.<br><br>DOLILU/I-LOADS:<br>- Selected and uplinked, DOLILU uplink #14, I-load uplink #20, last use of DOLILU I-load.<br><br>FLIGHT DURATION CHANGES: None<br><br>FIRSTS/SPECIAL EVENTS:<br>- Lowest perigee of all space shuttle flights of 85 nm (phasing maneuver) achieved during initial orbit.<br>- Smallest OMS-2 Delta V of 75.5 FPS.<br>- First permanent transfer of Russian/American crews (Mir-19 up and Mir-18 crew down on Atlantis - 7 up, 8 down).<br>- Carried up orbiter docking system and attached to Mir.<br>- First docking of U.S. & Russian spacecraft since Apollo-Soyuz in 1975.<br><br>EVENTS:<br>- Thagard lifted off from Baikonur Cosmodrome in Kazakhstan on March 14, 1995, at 9:11:00 AM local time (73:06:11:00Z).<br>- Total Soyuz/Mir time for Thagard 107:09:57:18, total flight time 115:08:43:35.<br>- Mir/Shuttle capture at 180:13:00:14Z, docking complete at 180:13:08:18Z.<br>- Crews transfer time at 180:16:08:18Z (Mir 19 from Atlantis to Mir, and Mir 18 to Atlantis, when seat liners transferred to Atlantis).<br>- Transferred equipment, experiments, 1067 lbm H <sub>2</sub> O, 48 lbm O <sub>2</sub> , and 87 lbm N <sub>2</sub> to Mir.<br>- Undocking completed at 185:11:09:42Z. |



STS-71 KSC-95EC-0913 Liftoff of 100th U.S. human space flight. It featured the 1st docking between the U.S. Space Shuttle and the Russian Space Station Mir.



Continued ...



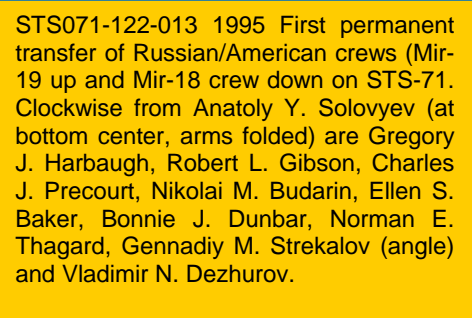

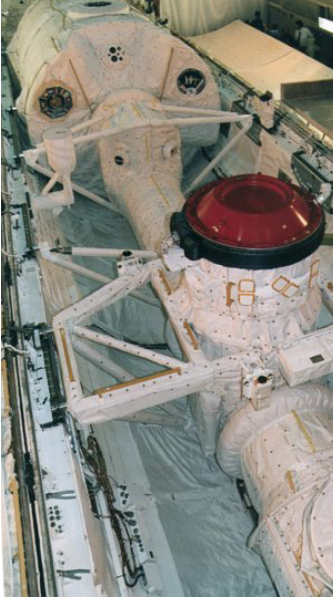

Continued ...

Continued ...



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-84 - STS-71

| FLT NO.  | ORBITER | CREW (10) 7 UP - 8 DOWN)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.            | SRB<br>RSRM<br>AND<br>ET  | ORBIT  |   | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|--|---|--|--|---|--|---|-----|--|--|
|  |         |  |   |  |  |   | INC  | HA/HP   |     |  |  |
| STS-71 Continued...  |         | Continued ...<br><br>MCC FCR-1 (48)<br>FLIGHT DIRECTORS:<br>A/E - N. W. Hale<br>LD/O 1 - R. E. Castle<br>O 2 - P. L. Engelauf<br>PLNG - P. F. Dye<br>FD Moscow - W. D. Reeves<br>MOD - A. L. Briscoe | Continued ...<br><br>MIR-18 FLIGHT ENGINEER:<br>Gennady Strekalov<br>P393/R196/M171<br><br>MIR-18 COSMONAUT<br>RESEARCHER:<br>Norman E. Thagard<br>(Flt 5 - STS-7, STS 51-B,<br>STS-30, STS-42)<br>P394/R20/V14/M19   | Continued ...<br><br>MECO CMD:<br>8:30:72 8:31.1<br>VI:<br>25876.5 25871<br><br>OMS-2:<br>42:57.2 42:57.2<br>Delta V 75.5 FPS<br>TGO = 00:47 | Continued ...<br><br>OV-104:<br>93:03:49:17<br><br>DISTANCE:<br>4,100,000 sm |   |  |   |     | Continued ...<br><br>RENDEZVOUS #21:<br>- Rendezvous and dock with Russian Mir Space Station (first docking).<br><br>SIGNIFICANT ANOMALIES:<br>- Postflight disassembly of RSRM nozzle joint 3 revealed RTV gas paths with slight heat effect and erosion to primary O-rings of STS-71 LH RSRM and STS-70 RH RSRM. Technique developed to remove RTV from joint and do a vacuum backfill for STS-69 and STS-73 RSRM's.<br>- GPC 4 annunciated GPC BITE fault message followed by GPC 4 fail. Determined to be single event upset, GPC 4 was assigned string 4 and used successfully during entry.<br>- Slow docking module vestibule depress rate.<br>- H <sub>2</sub> manifold valve tank 1 failed open.<br>- Cryo O <sub>2</sub> tank 1 leak through flight cap of fill/drain line OD.<br>- H <sub>2</sub> manifold valve 1 microswitch failure.<br>- Erratic O <sub>2</sub> tank 5 heater temperature.<br>- VHF system transmit failure.<br>- PDIP power fail.<br>- S-band comm string 2 uplink problem.<br>- RCS jettison R2U fail off (low chamber pressure). |  |
| KSC-95EC-0544 Spacelab-Mir module and transfer tunnel at KSC. In foreground is Obiter Docking system (ODS) topped with red Russian Androgynous Peripheral Docking System (APDS). |         |  | ABOVE RIGHT: NM18-309-028 -- As Atlantis approaches Mir docking node, MCC/CSR Rep James Nise reported that MIR Cosmonaut Strekalov happily yelled, "The banana truck is here!" (A reference to the days when Russia imported bannas from Cuba.)<br><br>BELOW: Soyuz photo of Shuttle docked to MIR from link:<br><a href="http://io.jsc.nasa.gov/photos/10280/hires/sts071-s-072.jpg">http://io.jsc.nasa.gov/photos/10280/hires/sts071-s-072.jpg</a><br>Provided by Gregory A. Lange JSC-/DA8 |  |  |    |  |   |     |    |  |
|   |         |  |   |  |  | STS071-122-013 1995 First permanent transfer of Russian/American crews (Mir-19 up and Mir-18 crew down on STS-71. Clockwise from Anatoly Y. Solovyev (at bottom center, arms folded) are Gregory J. Harbaugh, Robert L. Gibson, Charles J. Precourt, Nikolai M. Budarin, Ellen S. Baker, Bonnie J. Dunbar, Norman E. Thagard, Gennadiy M. Strekalov (angle) and Vladimir N. Dezhurov. |  | s95-16417.jpg -- MOD FD, Alan Briscoe (left) leads Post-Mission toast in CSR to success of first Shuttle-MIR docking and first permanent transfer of Russian/American crews (Mir-19 up and Mir-18 crew down). |     |  |  |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-85 - STS-70

| FLT NO.   | ORBITER  | CREW (5)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE,<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET  | ORBIT<br>INC HA/HP |   | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--|--|---|---|--|---|--------------------|---|--------------|--|--|
| STS-70<br>SEQ<br>FLT #70<br><br>KSC-70<br>PAD 39B-28<br>MLP-2 | OV-103<br>(Flight 21)<br>Discovery<br><br>OMS PODS:<br>LPO1-24<br>RPO3-22<br>FRC3-21 | CDR:<br>Terence T. (Tom) Henricks<br>(Flt 3 - STS-44, STS-55)<br>P395/R135/V93/M120<br><br>PLT:<br>Kevin R. Kregel<br>P396/R197/ M172<br><br>M/S 1:<br>Donald A. Thomas<br>(Flt 2 - STS-65)<br>P397/R180/V119/M158<br><br>M/S 2:<br>Nancy J. (Sherlock) Currie<br>(Flt 2 - STS-57)<br>P398/R165/V120/F21<br><br>M/S 3:<br>Mary Ellen Weber<br>P399/R198/F26<br><br>MCC FCR-1 (49)<br>(A/E & TDRS DEPLOY)<br><br>WHITE FCR (1)<br>(ON ORBIT OPS)<br><br>FLIGHT DIRECTORS:<br>A/E - R. D. Jackson<br>LD/O 2 - R. M. Kelso<br>O 1 - J. P. Shannon<br>PLNG - B. P. Austin<br>MDR 1 - C. W. Shaw<br>MDR 2 - J. M. Heflin<br>MOD - B. R. Stone | KSC PAD 39B<br>194:13:41:55Z<br>9:41:00 AM EDT (P)<br>9:41:55 AM EDT (A)<br>Thursday 19<br>7/13/95 (4)<br><br>LAUNCH WINDOW:<br>2H30M CTOB<br><br>EOM PLS: KSC<br>TAL: BEN<br>TAL WX: MRN<br><br>SELECTED:<br>RTLS: KSC 15/N/N<br>TAL: BEN 36/N/N<br>AOA: EDW 22/N/N<br>PLS: EDW 22/N/N<br><br>TDEL:<br>0.0 0.12/0.05<br><br>MAX Q NAV:<br>692 686<br><br>SRB STG:<br>2:02.7 2:05<br><br>PERE: NOMINAL<br><br>2 ENG TAL (BEN):<br><br>NEG RETURN:<br>3:59 4:03<br><br>PTA (U/S 244):<br>5:03 5:01<br><br>DROOP (BYD):<br>5:00 5:31<br><br>PTM (U/S):<br>5:46 5:47<br><br>SE TAL (BYD):<br>5:59 6:06<br><br>SE PTM (U/S 537):<br>7:01 7:01<br><br>MECO CMD:<br>8:30.75 8:30.7<br><br>VI: 25876 25874<br><br>OMS-2:<br>39:54.9 39:55<br>DELTA V 222 FPS | KSC 33 (KSC 24)<br>203:12:02:00Z<br>8:02:00 AM EDT<br><br>Saturday 14<br>7/22/95 (6)<br><br>DEORBIT BURN:<br>203:11:00:13Z<br><br>X RANGE: 430 NM<br><br>ORBIT DIR: DL 33<br>AIM PT: NOMINAL<br>MLGTD: 2601 FT<br>203:12:02:00Z<br>VEL: 198 KGS<br>194 KEAS<br>HDOT: -1.4 FPS<br><br>TD NORM 195:<br>2400 FT<br><br>DRAG CHUTE<br>DEPLOY: 189 KEAS<br>203:12:02:03Z<br><br>NLGTD: 5460 FT<br>203:12:02:09Z<br>VEL: 164 KGS<br>HDOT: -6.1 FPS<br><br>BRK INIT: 89 KGS<br><br>DRAG CHUTE<br>JETTISON: 59 KGS<br>203:12:02:35Z<br><br>AVE BRK DECEL:<br>4.6 FPS/S<br><br>WHEELS STOP:<br>203:12:02:58Z<br>11066 FT<br><br>ROLLOUT:<br>8465 FT<br>58 SEC<br><br>WINDS:<br>T2, L2 KTS<br>OFFICIAL:<br>2005 P8<br>T3, L4 KTS<br><br>DENS ALT:<br>1117 FT<br><br>FLT DURATION:<br>8:22:20:05<br>214:20:05<br><br>S/T: 535:16:14:36<br><br>OV-103:<br>145:23:49:54<br><br>DISTANCE:<br>3,700,000 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104/<br>67/104<br><br>ACTUAL:<br>100/104/104/<br>67/104<br><br>SSME S/N:<br>1 = 2036 (1)<br>2 = 2019 (15)<br>3 = 2017 (12)<br><br>M 3 EOM:<br>WEIGHT:<br>194267 LBS<br>X CG:<br>1097.2<br><br>LANDING:<br>WEIGHT:<br>194190 LBS<br>X CG:<br>1099.1 | BI-073<br><br>RSRM<br>44<br><br>ET-71<br><br>LWT<br>64<br><br>ET<br>RPT<br>27TK<br><br>ET<br>BR/UP<br>214K<br><br>ET<br>IMPACT<br>1:20:13<br>MET<br>LAT:<br>13.75°S<br>LONG:<br>163°W | 28.45°<br>(38)     | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>160.9 X<br>160.7 NM<br><br>DEORBIT:<br>166 X 155 NM<br><br>VELOCITY:<br>25789 FPS<br><br>ENTRY<br>RANGE:<br>4265 NM | OI-24<br>(2) | CARGO:<br>46799 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>44445 LBS<br><br>DEPLOYED:<br>37714 LBS<br><br>NON-DEPLOYED:<br>5585 LBS<br><br>MIDDECK:<br>1086 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>804398 LBS<br>NON-DEPLOYED:<br>973266 LBS<br>CARGO TOTAL:<br>2109762 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3775<br>FUEL BIAS: 1136<br>FINAL TDDP: 3789<br>RECON: 5299<br><br>PAYLOADS:<br>PLB:<br>TDRS-G/IUS<br>(DEPLOYED)<br><br>MIDDECK:<br>PARE/NIH-R,<br>BDS, CPCG,<br>STL/NIH-C, BRIC(2),<br>SAREX-II, VFT-4,<br>HERCULES, MIS-B,<br>MSX, MAST,<br>WINDEX, RME-III<br><br>4 CRYO TK SETS<br><br>NO RMS | KSC W/D: OPF 63, VAB 14 (2) PAD 43 (2) = 120 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date 6/29/95 on 3/18/94.<br>- Advanced launch date to 6/22/95 on 9/26/94.<br>- Advanced launch date to 6/8/95 on 5/2/95, moving STS-70 ahead of STS-71. Delays on SPEKTR launch & docking with Mir caused STS-71 launch to be postponed.<br>- Postponed 6/8/95 launch to 7/13/95 on 6/2/95 based on decision to rollback to VAB and repair holes (>200) in ET caused by a pair of woodpeckers (Northern Flickers). Moved STS-70 after STS-71.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH DELAYS:<br>- Launch delayed 55 seconds while holding at T-31 seconds due to Range Safety ET destruct package receiver fluctuating AGC (possible multipath).<br><br>TAL WX:<br>- BEN was prime and selected. MRN was forecast and observed NO GO due to crosswinds. Banjul in plane site was down for runway repair.<br><br>DOLILU/NOMINAL I-LOADS:<br>- First planned use of DOLILU II I-loads. DOLILU II was selected and uplinked. DOLILU II uplink #1, I-load uplink #21.<br><br>FLIGHT DURATION CHANGES:<br>- Waved off landing at KSC on orbits 127 and 128 because of forecast and observed low ceiling and ground fog.<br>- Waved off landing at KSC on orbit 142. Weather was observed GO but marginal with potential for ground fog but observed GO at landing time.<br>- Total flight extensions 1 day plus 1 orbit.<br><br>FIRSTS:<br>- First flight to be controlled by White FCR in new MCC (Bldg 30S) for most of orbit operations. Ascent and entry plus early and late orbit ops being controlled from old MCC FCR-1.<br>- First flight with Block I SSME (2036).<br><br>SIGNIFICANT ANOMALIES:<br>- Postflight disassembly of RSRM nozzle joint 3 revealed gas paths with slight heat effect and corrosion to primary o-ring of STS-70 RH RSRM.<br>- Erratic supply water tank C transducer.<br>- Ops recorder 2 track 3 degradation.<br>- Vacuum cleaner power cable pinched (IFM fixed).<br>- Crew reported W6 impact crater.<br>- Lost MOC capability when MOC went to 100% CPU. |






1st flight of one Block I SSME, shown in test, courtesy, Dan Hausman,/P&W/ Rocketdyne/ KSC



STS070-368-003 -- Inflight crew portrait With Ohio flag as backdrop: Left to right, Thomas/MS, Currie/MS, CDR Henricks, Weber/MS, PLT Kregel.



## Page 2-86 - STS-69

| FLT NO.   | ORBITER                     | CREW (5)   | LAUNCH SITE, LIFTOFF TIME,   | LANDING SITE/ RUNWAY, CROSSRANGE  | LSME-TL NOM-ABORT EMERG  | SRB RSRM   | ORBIT       |  | FSW       | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|-----------------------------|--|--|---|--|--|-------------|--|-----------|--|--|
|   |                             | TITLE, NAMES & EVA'S   | LANDING SITES, ABORT TIMES   | LANDING TIMES FLT DURATION, WINDS   | THROTTLE PROFILE ENG. S.N.   | AND ET   | INC         | HA/HP  |           |  |  |
| STS-69  | OV-105 (Flight 9) Endeavour | CDR: David M. Walker (Flt 4 - STS 51-A, STS-30, STS-53) P400/R48/V40/M45<br><br>PLT: Kenneth D. Cockrell (Flt 2 - STS-56) P401/R159/V121/M140<br><br>M/S 1 (PAYLOAD CDR): James S. Voss (Flt 3 - STS-44, STS-53) P402/R136/V85/M121<br><br>M/S 2/EV-1: James H. Newman (Flt 2 - STS-51) P403/R168/V122/M146<br><br>M/S 3/EV-2: Michael L. Gernhardt P404/R199/M173<br><br>SS EVA #30 EMU/Tethered EVA Scheduled EVA #26 EVA flight test (EDFT) #2 to evaluate space suit mods to protect space walkers from the cold of space, including heated gloves & LCVG leg bypass) PET 6H46M11S . | KSC 39A 250:15:08:59.96Z 11:09:00 AM EDT (P) 11:09:00 AM EDT (A) Thursday 20 9/7/95 (7)<br><br>LAUNCH WINDOW: 2H30M CTOB<br><br>EOM PLS: KSC TAL: BEN TAL WX: MRN<br><br>SELECTED: RTLS: KSC 15/C/N TAL: BEN 36/N/N AOA: EDW 22/N/N PLS: EDW 22/N/N<br><br>TDEL: 0.0 0.032/-0.09<br><br>MAX Q NAV: 705 PSF 715 PSF<br><br>SRB SEP: 2:03.7 1:59.1<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN): 2:40 2:49<br><br>NEG RETURN: 4:01 4:02<br><br>PTA (U/S 328): 4:18 4:14<br><br>DROOP (BYD): 5:28 5:30<br><br>PTM (U/S 328): 5:24 5:24<br><br>SE TAL (BYD): 5:51 5:52<br><br>LAST TAL (BEN): 6:28<br><br>MECO CMD: 8:30.2 8:30.2<br><br>MECO VI: 25946 25940<br><br>OMS-2: 41:43 41:43 293.4 FPS 293.4 FPS | KSC 33 (KSC 25) 261:11:37:55Z 7:37:55 AM EDT<br><br>Monday 14 9/18/95 (8)<br><br>DEORBIT BURN: 261:10:35:13Z<br><br>XRANGE: 202 NM<br><br>ORBIT DIR: DL 34<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 1912 FT 261:11:37:55Z<br><br>VEL: 218 KGS 212 KEAS HDOT: -4 FPS<br><br>TD NORM 205: 2468 FT<br><br>DRAG CHUTE DEPLOY: 187 KEAS 261:11:38:03Z<br><br>NLGTD: 6325 FT 261:11:38:08Z<br><br>VEL: 167 KGS HDOT: -6.5 FPS<br><br>BRK INIT: 97 KGS<br><br>DRAG CHUTE JETTISON: 62 KGS 261:11:38:36Z<br><br>AVE BRK DECEL: 5.6 FPS/S<br><br>WHEELS STOP: 261:11:38:55Z 12142 FT<br><br>ROLLOUT: 10230 FT 60 SEC<br><br>WINDS: T2, L4 KTS OFFICIAL: 2205P06, T2, L5 KTS<br><br>DENS ALT: 1315 FT<br><br>FLT DURATION: 10:20:28:55<br><br>S/T: 546:12:43:31<br><br>OV-105: 93:14:23:06<br><br>DISTANCE: 4,500,000 sm | 104/104/ 109%<br><br>PREDICTED: 100/104/104/ 67/104<br><br>ACTUAL: 100/104/104/ 67/104<br><br>1 = 2035 (2)<br>2 = 2109 (16)<br>3 = 2029 (12)<br><br>M 3 EOM: WEIGHT: 219395 LBS X CG: 1080.7<br><br>LANDING: WEIGHT: 219298 LBS X CG: 1082.3 | BI-074<br><br>RSRM 48 KM<br><br>ET-72<br><br>LWT 65<br><br>ET RPT 271K<br><br>ET BR/UP 214K<br><br>ET IMPACT 1:24:54 MET<br><br>LAT: 18.8°S<br><br>LONG: 151.9°W | 28.45° (39) | DIRECT INSERTION<br><br>POST OMS-2: 201 x 199 NM<br><br>DEORBIT: 186 x 181 NM<br><br>VELOCITY: 25839 FPS<br><br>ENTRY RANGE: 4332 NM | OI-24 (3) | CARGO: 31549 LBS<br><br>PAYLOAD CHARGEABLE: 25346 LBS<br><br>DEPLOYED: 0 LBS<br><br>NON-DEPLOYED: 16739 LBS<br><br>MIDDECK: 1301 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 804398 LBS NON-DEPLOYED: 991306 LBS CARGO TOTAL: 2141311 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3775 FUEL BIAS: 1136 FINAL TDDP: 5409 RECON: 7966<br><br>PAYLOADS: PLB: WSF (Wakeshield Facility), IEH, Spartan-201-03 CAPL-II/GBA<br><br>MIDDECK: STL/NIH-C CGBA, BRIC, EPICS CMIX<br><br>5 CRYO TK SETS<br><br>RMS 42 (S.N. 303)<br><br>RMS USED TO DEPLOY AND RETRIEVE SPARTAN AND WSF. SUPPORT FOR EVA AND CLAWS. | KSC W/D: OPF 81, VAB 7 PAD 47 (2) = 135 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 3/16/95 on 11/18/93.<br>- Postponed launch date to 5/4/95 on 3/24/94.<br>- Postponed launch date to 7/20/95 on 10/6/94.<br>- Postponed launch date to 8/5/95 caused by delays in STS-71 and STS-70.<br>- Postponed launch date to 8/31/95 while program analyzed RTV gas paths in nozzle joint #3 on STS-71 and STS-70, then developed a fix for STS-69.<br>- Rolled back to VAB on 8/1/95 under threat of Hurricane Erin.<br>- Returned to pad on 8/8/95.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 8/31/95 launch at approx. L-7.5 hours when fuel cell 2 condenser exit temperature exceeded LCC limit of 160 deg F.<br>- Rescheduled launch for 9/7/95.<br><br>LAUNCH DELAYS: None<br><br>TAL WX:<br>- BEN (prime and selected), MRN forecast NO GO for ceiling and rain but observed GO 10 mins prior to landing time.<br><br>DOLILU II/NOMINAL I-LOADS:<br>- Nominal I-loads were not certified for September. DOLILU-II I-loads uplinked. DOLILU-II uplink #2, total DOLILU uplink #16 I-load uplink #22.<br><br>FLIGHT DURATION CHANGES: None<br><br>EVENTS:<br>- SPARTAN released 1:00:38:59, grapple 2:23:53, latched 3:00:03 MET.<br>- WSF released 3:20:16:15, grapple 6:22:50:11 MET.<br><br>RENDEZVOUS #22:<br>- Rendezvous, grapple & berth WSF.<br><br>RENDEZVOUS #23:<br>- Rendezvous, grapple & berth SPARTAN 201-03.<br><br>SIGNIFICANT ANOMALIES:<br>- CRT 1 dim display.<br>- Fuel cell 2 condenser exit temp high (scrubbed launch attempt).<br>- Waste dumlpe blockage. IFM to bypass dump filter was unsuccessful, so off loaded waste tank into CWC.<br>- EVA power tool failed.<br>- Portable foot restraint fit problem.<br>- S-band preamp 2 degraded causing intermittent forward link.<br>- Middeck speaker ATU failure.<br>- Camcorder tape eject failure.<br>- Camera D downlink lost.<br>- Loss of Ku-band forward link.<br>- Random ops recorder commands issued when panel brightness control adjusted in new MCC.<br>- Hydraulics pump 3 stuck in norm press (cycled switch twice to get response then started APU<br>- WSB 3 lub oil overcooling during entry. |
| SEQ FLT #71   |                             |  |  |   |  |  |             |  |           |  |  |
| KSC-71  |                             |  |  |   |  |  |             |  |           |  |  |
| PAD 39A-43  |                             |  |  |   |  |  |             |  |           |  |  |
| MLP-1   |                             |  |  |   |  |  |             |  |           |  |  |
|   |                             |  |  |   |  |  |             |  |           |  |  |
| MCC FCR-1 (50) (A/E) WHITE FCR (2) (ORBIT) FLIGHT DIRECTORS: A/E - N. W. Hale LD/O 1 - J. W. Bantle O 2 - P. F. Dye PLNG - G. A. Pennington MOD - A. L. Briscoe |                             |  |  |   |  |  |             |  |           |  |  |
|    |                             |  |  |   |  |  |             |  |           |  |  |
| S95-07799 -- FD's team in MCC. FD Al Pennington (left front) & CAPCOM David Wolf shaking hands.   |                             |  |  |   |  |  |             |  |           |  |  |
|    |                             |  |  |   |  |  |             |  |           |  |  |
| STS069-715-050 Crew in middeck: Front (lt to rt) PLT Cockrell and CDR Walker. Backrow: (lt to rt) Voss/MS/PLC, Gearhardt/MS, and Newman/MS.                     |                             |  |  |   |  |  |             |  |           |  |  |



## Page 3-87 - STS-73

[illegible]

## Page 2-88 - STS-74

[illegible]






## Page 2-89 - STS-72

[illegible]



## Page 2-90 - STS-75

| FLT NO.   | ORBITER  | CREW (7)  | LAUNCH SITE, LIFTOFF TIME,   | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG   | SRB RSRM  | ORBIT          |  | FSW          | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--|---|--|--|---|---|----------------|--|--------------|--|---|
|   |  | TITLE, NAMES & EVA'S  | LANDING SITES, ABORT TIMES   | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N.  | AND ET  | INC            | HA/HP  |              |  |   |
| STS-75<br>SEQ<br>FLT #75<br><br>KSC-75<br><br>PAD<br>39B-31<br><br>MLP-3  | OV-102<br>(Flight 19)<br>Columbia<br><br><br>OMS PODS:<br>LPO5-8<br>RPO1-23<br>FRC2-19 | CDR:<br>Andrew M. Allen<br>(Flt 3 - STS-46, STS-62)<br>P423/R149/V101/M133<br><br>PLT:<br>Scott J. Horowitz<br>P424/R210/M183<br><br>M/S 1:<br>Jeffrey A. Hoffman<br>(Flt 5 - STS 51-D, STS-35,<br>STS-46, STS-61)<br>P425/R57/V59/M52<br><br>M/S 2:<br>Maurizio Cheli<br>(Italy-ESA)<br>P426/R211/M184<br><br>M/S 3:<br>Claude Nicollier<br>(Switzerland - ESA)<br>(Flt 3 - STS-46, STS-61)<br>P427/R150/V98/M134<br><br>M/S 4/PAYLOAD CDR:<br>Franklin R. Chang-Diaz<br>(Flt 5 - STS 61-C, STS-34,<br>STS-46, STS-60)<br>P428/R89/V46/M81<br><br>P/S1:<br>Humberto Guidoni<br>(Italy)<br>P429/R212/M185 | KSC 39B<br>53:20:17:59:97Z<br>3:18:00 PM EST (P)<br>3:18:00 PM EST (A)<br>Thursday 22<br>2/22/96 (5)<br><br>LAUNCH WINDOW:<br>2H30M CTOB<br><br>EOM PLS: KSC<br>TAL: BEN<br>TAL WX: MRN<br><br>SELECTED:<br>RTL: KSC 15/N/N<br>TAL: BEN 36/N/N<br>AOA: KSC 15/N/N<br>PLS: KSC 15/N/N<br><br>TDEL:<br>0.0      0.182/0.22<br><br>MAX Q NAV:<br>690                  697<br><br>SRB STG:<br>2:06.9              2:09<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>3:06                  3:07<br><br>NEG RETURN:<br>3:57                  3:59<br><br>PTA (U/S 242):<br>4:59                  5:00<br><br>DROOP:<br><br><br>PTM:<br>6:02                  5:58<br><br>MECO CMD:<br>8:27.4                8:28.3<br><br>VI:<br>25877                 25869<br><br>OMS-2:<br>39:56                 39:52<br>223 FPS              222 FPS | KSC 33 (KSC-29)<br>69:13:58:20Z<br>8:58:20 AM EST<br><br>Saturday 16<br>3/9/96 (6)<br><br>DEORBIT BURN:<br>69:12:55:43Z<br><br>XRANGE: 234 NM<br><br>ORBIT DIR: DL 36<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 2175 FT<br>69:13:58:20Z<br>VEL: 189 KGS<br>211 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 205:<br>2706 FT<br><br>DRAG CHUTE<br>DEPLOY: 193 KEAS<br>69:13:58:28Z<br><br>NLGTD: 6451 FT<br>69:13:58:36Z<br>VEL: 130 KGS<br>HDOT: -5.2 FPS<br><br>BRK INIT: 100 KGS<br><br>DRAG CHUTE<br>JETTISON: 62 KGS<br>69:13:58:52Z<br><br>AVE BRK DECEL:<br>3.8 FPS/S<br><br>WHEELS STOP:<br>69:13:59:25Z<br>10635 FT<br><br>ROLLOUT:<br>8460 FT<br>65 SEC<br><br>WINDS:<br>HT3: 0X KTS<br>OFFICIAL:<br>3312P20 H12, L2<br><br>DENS ALT: -1645 FT<br><br>FLT DURATION:<br>15:17:40:21<br><br>S/T:<br>595:06:47:37<br><br>OV-102:<br>183:02:17:35<br><br>DISTANCE:<br>6,500,000 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104/<br>67/104<br><br>ACTUAL:<br>100/104/104/<br>67/104<br><br>1 = 2029 (13)<br>2 = 2034 (7)<br>3 = 2017 (13)<br><br>M 3 EOM:<br>WEIGHT:<br>226443 LBS<br>X CG:<br>1079.40<br><br>LANDING:<br>WEIGHT:<br>226287 LBS<br>X CG:<br>1080.94 | BI-078<br><br>RSRM<br>53<br><br>ET-76<br><br>LWT-69<br><br>ET<br>RPT<br>271K<br><br>ET<br>BR/UP<br>214K<br><br>ET<br>IMPACT<br>1:20:58<br>MET<br>LAT:<br>13.6°S<br>LONG:<br>163.3°W           | 28.46°<br>(41) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>161.9 x 160.2<br>NM<br><br>USMP<br>PRCS 1<br>5/21:45:00<br>160.1 x 153.5<br><br>MEPHESTO:<br>10:12:25:00<br>MET<br>158.4 X 149.4<br>NM<br><br>DEORBIT:<br>173 x 146 NM<br><br>VELOCITY:<br>25816 FPS<br><br>ENTRY<br>RANGE:<br>4375 NM | OI-24<br>(6) | CARGO:<br>32006 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>23353 LBS<br><br>DEPLOYED:<br>1494 LBS<br><br>NON-DEPLOYED:<br>20490 LBS<br><br>MIDDECK:<br>1369 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>815907 LBS<br>NON-DEPLOYED:<br>1053968 LBS<br>CARGO TOTAL:<br>2251727 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3775<br>FUEL BIAS: 1136<br>FINAL TDDP: 1594<br>RECON: 638<br><br>PAYLOADS:<br>PLB:<br>TETHERED<br>SATELLITE<br>SYSTEM REFLIGHT<br>(TSS-1R)<br>U.S.<br>MICROGRAVITY<br>PAYLOAD<br>SEMICONDUCTOR<br>EXPERIMENTS<br>(USMP-3)<br>OARE<br><br>MIDDECK:<br>TSS SUPPORT<br>EQUIPMENT<br>MBGX<br>CPCG<br><br>5 CRYO TK SETS<br>PLUS 4 EDO<br>EDO PALLET<br><br>NO RMS | KSC W/D: OPF 64, VAB 5, PAD 25 = 94 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 2/15/96 on 10/13/94.<br>- Postponed launch date to 2/22/96 on 12/1/95.<br><br>LAUNCH SCRUBS: NONE<br><br>LAUNCH DELAYS: NONE<br><br>TAL WX:<br>- Both BEN (prime & selected) and MRN were forecast and observed GO. BYD was not available as an intact abort site due to local situation.<br><br>DOLILU-II I-LOADS:<br>- DOLILU II uplink #6, I-load uplink #25.<br><br>FLIGHT DURATION CHANGES:<br>- Extended flight 1 day for additional USMP science.<br>- Decision to not try to land on orbit 235 due to forecast of low ceiling. Waived off landing on orbits 236 and 237 due to forecast of low ceiling. Extended flight second day for weather.<br>- Waived off landing at KSC on orbit 251 due to forecast of low ceiling.<br>- Total flight duration extension of 2 days plus one orbit.<br><br>FIRSTS/LASTS:<br>- First flight with thermocouple transducers on all 3 engines.<br><br>EVENTS:<br>- TSS deployed at 03:00:27:00 MET, tether broke at 03:05:11:35, tether length of 19,695 meters, and TSS separated rapidly from orbiter. Tether was rewound starting at 03:21:49:00 MET and boon retraction completed at 03:02:41 MET.<br><br>SIGNIFICANT ANOMALIES:<br>- Left main engine chamber pressure read 40% in lieu of 104%.<br>- FA1 MDM card 0 failure during FCS C/O, aerosurfaces not receiving commands from FA1 (waiver written to F/R 2-30A.2a, MDF or next PLS).<br>- Topping FES core icing used, ice flush procedure.<br>- Fuel cell 3 CPM not doing self-test.<br>- H <sub>2</sub> tank 4 heater A failure.<br>- AC 1 phase B short caused loss of utility outlets J31 and J7.<br>- IMU 3 X and Y axis drift, compensations up to 8 sigma. Powered off to preserve lifetime. Used for entry but continued high drift rates.<br>- MLS 2 did not lock on in range.<br>- S-band transponder 2 failed to acquire TDRS (forward link).<br>- MOC processing problems.<br>- APU 1 fuel pump inlet pressure decay.<br>- TSS was lost when tether parted when being deployed (at 19.7 kilometers).<br>- Uncommanded SFMDM warm starts.<br>- LH aft structure attach (to ET) blade valve not fully closed (debris catcher). |
|   |  |   |  |  |   |   |                |  |              |  |   |
| MCC FCR-1 (54)<br>ASCENT/ENTRY<br><br>WHITE FCR (5)<br>FOR ORBIT OPS<br><br>FLIGHT DIRECTORS:<br>A/E - R. D. Jackson<br>LD/O 2 - C. W. Shaw<br>O 1 - G. A. Pennington<br>O 3 - R. E. Castle<br>O 4 - J. P. Shannon<br>MOD - A. L. Briscoe |      |   |  |  |   |   |                |  |              |  |   |
| Tethered Satellite System (TSS)   |  |   |  |  |   |   |                |  |              |  |   |
|    |  |   |  |  |   | sts075-772-020 --- Inflight crew portrait:<br>(bottom center) CDR Allen. Clockwise<br>from him: Chang-Diaz/PLC, Cheli/MS,<br>Nicollier/MS- ESA, PLT Horowitz,<br>Guidioni/PS-ASI, Hoffman/MS. |                |  |              |  |   |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-91 - STS-76

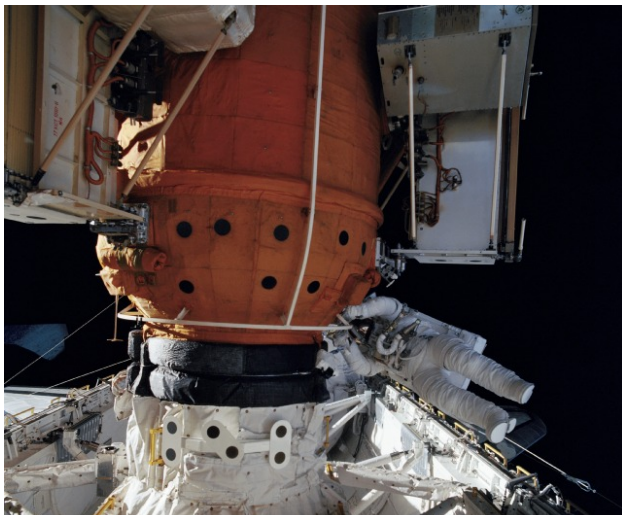


| FLT NO.  | ORBITER   | CREW (6)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET   | ORBIT         |  | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|---|---|--|---|---|--|---------------|--|--------------|--|--|
| STS-76<br>SEQ<br>FLT #76<br>KSC-76<br>PAD<br>39B-32<br>MLP-2 | OV-104<br>(Flight 16)<br>Atlantis<br>Spacehab 4<br>OMS PODS:<br>LPO3-20<br>RPO4-16<br>FRC4-16 | CDR:<br>Kevin P. Chilton<br>(Flt 3 - STS-49, STS-59)<br>P430/R145/V103/M129<br>PLT:<br>Richard A. Searfoss<br>(Flt 2 - STS-58)<br>P431/R171/V126/M149<br>M/S 1 (PAYLOAD CDR):<br>Ronald M. Sega<br>(Flt 2 - STS-60)<br>P432/R175/V127/M153<br>M/S 2/EV 2:<br>M. Richard Clifford<br>(Flt 3 - STS-53, STS-59)<br>P433/R157/V104/M139<br>M/S 3/EV 1:<br>Linda M. Godwin<br>(Flt 3 - STS-37, STS-59)<br>P434/R122/V105/F13<br>M/S 4:<br>Shannon W. Lucid<br>(Flt 5 - STS-51-G, STS-34,<br>STS-43, STS-58, to return<br>on STS-79)<br>P435/R65/V45/F6<br>SS EVA #33<br>Tethered with SAFER CTGY<br>EV 1 - Linda Godwin<br>EV 2 - Rich Clifford<br>Scheduled EVA #29<br>To install MEEP on Mir DM,<br>evaluate EVA H/W, aids &<br>tools.<br>3/27/96 - 6:02:28 Duration | KSC PAD 39B<br>82:08:13:03.9Z<br>3:13:04 AM EST (P)<br>3:13:04 AM EST (A)<br>FRIDAY 15<br>3/22/96 (6)<br>LAUNCH WINDOW:<br>6M59S<br>MIR PLANAR/<br>PHASE WINDOW<br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br>SELECTED:<br>RTL: KSC 33/C/N<br>TAL: ZZA 30/N/N<br>AOA: KSC 33/C/N<br>PLS: EDW 22/N/N<br>TDEL:<br>0.09 0.492/0.49<br>MAX Q NAV:<br>720 PSF 724 PSF<br>52 SECS MET<br>SRB STG:<br>2:05.5 2:09<br>PERF: NOMINAL<br>2 ENG TAL (BEN):<br>2:25 2:28<br>NEG RETURN:<br>4:06 4:09<br>PTA (U/S 242):<br>4:23 4:24<br>DROOP (ZZA):<br>5:24 5:23<br>PTM:<br>5:54 5:58<br>SE TAL (ZZA):<br>5:54 6:09<br>MECO CMD:<br>8:32.6 8:33.2 | EDW 22, CONC<br>(EDW 45, CONC 26)<br>91:13:28:57Z<br>5:28:57 AM PST<br>SUNDAY 11<br>3/31/96 (7)<br>DEORBIT BURN:<br>91:12:23:08Z<br>X RANGE: 763 NM<br>ORBIT DIR: DR 16<br>AIM PT: NOMINAL<br>MLGTD: 2185 FT<br>91:13:28:57Z<br>VEL: 204 KGS<br>198 KEAS<br>HDOT: -1.6 FPS<br>TD NORM 195:<br>2433 FT<br>DRAG CHUTE<br>DEPLOY: 188 KEAS<br>91:13:29:00Z<br>NLGTD: 5747 FT<br>91:13:29:08Z<br>VEL: 154 KGS<br>HDOT: -5.0 FPS<br>BRK INIT: 116 KGS<br>DRAG CHUTE<br>JETTISON: 54 KGS<br>91:13:29:31Z<br>AVE BRK DECEL:<br>5.4FPS/S<br>WHEELS STOP:<br>91:13:29:52Z<br>10579 FT<br>ROLLOUT:<br>8394 FT<br>55 SEC<br>WINDS:<br>H0, L1 KTS<br>OFFICIAL:<br>1301P04 T0, L1<br>Continued . . . | 104/104/<br>109%<br>PREDICTED:<br>100/104/104/<br>67/104<br>ACTUAL:<br>100/104/104/<br>69/104<br>1 = 2035 (3)<br>2 = 2109 (16)<br>3 = 2019 (16)<br>M 3 EOM:<br>WEIGHT:<br>211913 LBS<br>X CG:<br>1082.76<br>LANDING:<br>WEIGHT:<br>211805 LBS<br>X CG:<br>1084.46 | BI-079<br>RSRM<br>46<br>ET-77<br>LWT-70<br>ET<br>RPT<br>271K<br>ET<br>BR/UP<br>269K<br>ET<br>IMPACT<br>1:25:49<br>MET<br>LAT:<br>0.1°N<br>LONG:<br>125.4°W | 51.65°<br>(4) | DIRECT<br>INSERTION<br>POST OMS-2:<br>158.5 x 85.1<br>NM<br>MIR-RNDZ<br>MNVR AT<br>1/01:11 MET<br>210 x 127 NM<br>TI:<br>1:15:28:01 MET<br>215.8 x 206.3<br>NM<br>DEORBIT:<br>216 X 206 NM<br>VELOCITY:<br>25898 FPS<br>ENTRY<br>RANGE:<br>4243 NM | OI-24<br>(7) | CARGO:<br>24605 LBS<br>PAYLOAD<br>CHARGEABLE:<br>14152 LBS<br>DEPLOYED:<br>2814 LBS<br>NON-DEPLOYED:<br>10578 LBS<br>MIDDECK:<br>760 LBS<br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>818721 LBS<br>NON-DEPLOYED:<br>1065306 LBS<br>CARGO TOTAL:<br>2276332 LBS<br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3775<br>FUEL BIAS: 1136<br>FINAL TDDP: 3140<br>RECON: 3563<br>PAYLOADS:<br>PLB:<br>SHUTTLE/MIR<br>MISSION 3<br>SPACEHAB 4<br>ORBITER DOCKING<br>SYSTEM (ODS)<br>MIDDECK:<br>KIDSAT<br>SAREX-II<br>5 CRYO TK SETS<br>NO RMS | KSC W/D: OPF 68, VAB 6, PAD 22 = 96 days total.<br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 3/21/96 on 12/14/94.<br>LAUNCH SCRUBS:<br>- Scrubbed 3/21/96 launch at ET tanking MMT on 3/20/96 at approx. L-8 hours due to weather forecast of excessive RTL crosswinds, chance of 5000' broken ceiling at KSC, and high seas in SRB recovery area.<br>LAUNCH DELAYS: None<br>TAL WX:<br>- ZZA (prime and selected) and MRN were forecast and observed GO. BEN forecast and observed NO GO for ceiling and visibility.<br>DOLILU-II I-LOADS:<br>- DOLILU-II I-Loads uplinked (#8), I-Load uplink #27.<br>SPACE SHUTTLE NIGHT LAUNCH: #13<br>FLIGHT DURATION CHANGES/LANDING SITE CHANGE:<br>- MMT decision on 3/28/96 to land 1 day early on 3/30 (forecast of low ceiling & fog).<br>- Loss of APU 3 imposed weather placards, flight rule 10-4A.<br>- Waved off landing at KSC on orbit 129 due to overcast ceiling.<br>- Waved off landing at KSC on orbit 130. Extended flight 1 day to original duration.<br>- Waved off landing at KSC on orbit 144 due to ground fog.<br>Changed landing site to EDW.<br>- Total flight duration extension: one orbit.<br>FIRSTS/LASTS:<br>- Mir docking at 01:18:39:26, hatch opening at 01:20:18:00 MET.<br>- Shannon Lucid transferred to Mir 21 crew at 02:04:29:00 MET (84:12:42:04Z) and will return on STS-79.<br>- Fifteen CWC's, total of 1506 lbm water, 42 lbm N <sub>2</sub> , 62 lbm O <sub>2</sub> , 614 lbm food transferred to Mir.<br>- First EVA during orbiter/Mir docked operations at 04:22:23 MET.<br>- Mir undocking at 06:16:54:59 MET.<br>- Last flight from old MCC (FCR-1). First flight controlled from old MCC was Gemini 4.<br>RADIATOR DEPLOY #18:<br>- Port radiator deployed for 47 hours to conserve water for transfer to Mir.<br>RENDEZVOUS #27:<br>- Rendezvous and third docking with Mir Space Station (third docking flight).<br>Continued . . . |

NM21-727-030 (23 March 1996) --- Atlantis as seen from Mir during rendezvous.





# SPACE SHUTTLE MISSIONS SUMMARY


| FLT NO.  | ORBITER | CREW (6)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br><br>AND<br>ET | ORBIT |  | FSW | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|--|---------|--|--|--|--|------------------------------|-------|--|-----|--|--|--|
| STS-76<br><br>Continued  |         | Continued...<br><br>WHITE FCR (6)<br>ORBIT OPS & ENTRY<br><br>FLIGHT DIRECTORS:<br>A/E - J. W. Bantle<br>LD/O 1 - P. L. Engelauf<br>O 2 - W. D. Reeves<br>PLNG - P. F. Dye<br>MOD - R. E. Castle | Continued ...<br><br>VI:<br>25878      25871<br><br>OMS-2:<br>42:18.5      42:21.9<br>77.1 FPS      76.8 FPS | Continued ...<br><br>DENS ALT: 1536 FT<br><br>FLT DURATION:<br>9:05:15:53<br><br>S/T: 604:12:03:30<br><br>OV-105:<br>110:13:35:54<br><br>DISTANCE:<br>3,800,000 sm |    |                              |       |  |     | Continued ...<br><br>SIGNIFICANT ANOMALIES:<br>- Hydraulic System 3 leak during ascent (approximately 20% fluid lost), kept in low pressure for entry, F/R waiver S063689CU.<br>- WSB 3A failed to cool during ascent.<br>- WSB 2 overcooked post-MECO.<br>- Loss of PLBD centerline 9-12 release microswitch inclinations postlanding wave-off.<br>- WSB 3B steam vent heater transient failure.<br>- R4R fail off (low chamber pressure).<br>- L2L fail leak (oxidizer leak).<br>- L2U fail off (low chamber pressure).<br>- EVA camera bracket not onboard.<br>- EV 2 biomed (ECG) signal conditioner failed.<br>- EMU 2 battery power discrete fail on.<br>- MCC loss of forward link during countdown.<br>- Loss of KCA forward link.<br>- Water transfer mineral syringe failed to inject. |  |  |
|   |         |  |  |  | Above: STS076-724-016 -- Clifford works at restraining bar on Mir Docking Module. Clifford and Godwin mark first EVA while MIR & Shuttle are docked.<br><br>Below: NM21-399-001 --- Aboard Mir Base Block Module Lucid works out on treadmill. |                              |       |  |     |  |  |  |
| STS076-371-002 (25 March 1996) --- Inflight crew portrait on mid deck. From left on front row: Godwin/MS, CDR Chilton, and PLT Searfoss. Left to right on back row: Clifford/MS, Lucid/MS and payload commander Sega/PLC. Lucid later joined Mir-21 crew for first leg of her five-month stay. |         |  |  |  |  |                              |       |  |     |  |  |  |
|  |         |  |  |  |   |                              |       |  |     |  |  |  |




# SPACE SHUTTLE MISSIONS SUMMARY


Page 2-93 - STS-77

|  | ORBITER                            | CREW<br>(6)  | LAUNCH SITE,<br>LIFTOFF TIME,  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE   | SSME-TL<br>NOM-ABORT<br>EMERG  | SRB<br>RSRM   | ORBIT         |  | FSW          | PAYLOAD<br>WEIGHTS,  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|------------------------------------|--|--|--|--|---|---------------|--|--------------|--|--|
| NO.  |                                    | TITLE, NAMES<br>& EVA'S  | LANDING SITES,<br>ABORT TIMES  | LANDING TIMES<br>FLT DURATION,<br>WINDS  | THROTTLE<br>PROFILE<br>ENG. S.N.   | AND<br>ET   | INC           | HA/HP  |              | PAYLOADS/<br>EXPERIMENTS   |  |
| STS-77<br>SEQ<br>FLT #77<br>KSC-77<br>PAD<br>39B-33<br>MLP-1 | OV-105<br>(Flight 11)<br>Endeavour | CDR:<br>John H. Casper<br>(Flt 4 - STS-36, STS-54,<br>STS-62)<br>P436/R111/V86/M99<br><br>PLT:<br>Curtis L. Brown<br>(Flt 3 - STS-47, STS-66)<br>P437/R152/V112/M136<br><br>M/S 1:<br>Andrew S. W. Thomas<br>P438/R213/M186<br><br>M/S 2:<br>Daniel W. Bursch<br>(Flt 3 - STS-51, STS-68)<br>P439/R169/V109/M147<br><br>M/S 3:<br>Mario Runco, Jr.<br>(Flt 3 - STS-44, STS-54)<br>P440/R137/V89/M122<br><br>M/S 4:<br>Marc Garneau<br>(Canada)<br>(Flt 2 - STS 41-G)<br>P441/R47/V128/M44<br><br>MCC WHITE FCR (7)<br>(ALL OPS)<br><br>FLIGHT DIRECTORS:<br>AVE - R. D. Jackson<br>LD/O 2 - N. W. Hale<br>O 1 - B. P. Austin<br>PLNG - L. J. Ham<br>MOD - J. W. Bantle | KSC PAD 39B<br>140:10:29:59.973Z<br>6:30:00 AM EDT (P)<br>6:30:00 AM EDT (A)<br>Sunday 9<br>5/19/96 (3)<br><br>LAUNCH WINDOW:<br>2H30M CTOB<br><br>EOM PLS: KSC<br>TAL: BEN<br>TAL WX: MRN, ZZA<br><br>SELECTED:<br>RTLS: KSC 33/N/N<br>TAL: MRN 20/N/N<br>AOA: KSC 33/N/N<br>PLS: EDW 22/N/N<br><br>TDEL:<br>0.1 -0.108/0.09<br><br>MAX Q NAV:<br>693 701<br><br>SRB STG:<br>2:05.4 2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN):<br>2:40 2:36<br><br>NEG RETURN:<br>3:59 4:00<br><br>PTA (U/S 249):<br>4:45 4:36<br><br>DROOP (BYD):<br>5:23 5:23<br><br>PTM:<br>5:41 5:32<br><br>MECO CMD:<br>8:27.66 8:28.1<br><br>VI:<br>25865 25856<br><br>OMS-2:<br>41:47 41:47<br>2:06 2:07<br>198.5 FPS 198.6 FPS | KSC 33 (KSC 30)<br>150:11:09:20Z<br>7:09:20 AM EDT<br><br>Wednesday 8<br>5/29/96 (6)<br><br>DEORBIT BURN:<br>150:10:09:30Z<br><br>X RANGE: 314 NM<br><br>ORBIT DIR: DR 17<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 1687 FT<br>150:11:09:20Z<br>VEL: 216 KGS<br>216 KEAS<br>HDOT: -4.6 FPS<br><br>TD NORM 205:<br>2536 FT<br><br>DRAG CHUTE<br>DEPLOY: 191 KEAS<br>150:11:09:27Z<br><br>NLGTD: 6612 FT<br>150:11:09:35Z<br>VEL: 150 KGS<br>HDOT: -4.8 FPS<br><br>BRK INIT: 99 KGS<br><br>DRAG CHUTE<br>JETTISON: 59 KGS<br>150:11:09:56Z<br><br>AVE BRK DECEL:<br>6.8 FPS/S<br><br>WHEELS STOP:<br>150:11:10:11Z<br>10978 FT<br><br>ROLLOUT:<br>9291 FT<br>51 SEC<br><br>WINDS:<br>H0, L6 KTS<br>OFFICIAL: 2607P9<br>H2, L7<br><br>DENS ALT:<br>1012 FT<br><br>FLT DURATION:<br>10:00:39:20<br><br>S/T: 614:12:42:50<br><br>OV-105:<br>112:13:03:06<br><br>DISTANCE:<br>4,100,000 sm | 104/104/<br>10996<br><br>PREDICTED:<br>100/104/104/<br>67/104<br><br>ACTUAL:<br>100/104/104/<br>67/104<br><br>1 = 2037 (2)<br>2 = 2040 (1)<br>3 = 2038 (3)<br><br>M 3 EOM:<br>WEIGHT:<br>222399 LBS<br>X CG:<br>1080.45<br><br>LANDING:<br>WEIGHT:<br>222276 LBS<br>X CG:<br>1082.04 | BI-080<br><br>RSRM 47<br><br>ET-78<br><br>LWT 71<br><br>ET<br>RPT<br>271K<br><br>ET<br>BR/UP<br>214K<br><br>ET<br>IMPACT<br>1:24:57<br>MET<br>LAT:<br>2.97°N<br>LONG:<br>138.89°W | 39.03°<br>(5) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>152.9 x 152.8<br>NM<br><br>SPARTAN<br>DEPLOY:<br>153.6 x 150.4<br>NM<br><br>SPARTAN<br>GRAPPLE:<br>153.1 x 152.0<br>NM<br><br>PAMS/STU<br>DEPLOY:<br>152.6 x 152.0<br>NM<br><br>DEORBIT:<br>154 x 147 NM<br><br>VELOCITY:<br>25763 FPS<br><br>ENTRY<br>RANGE:<br>4378 NM | OI-24<br>(8) | CARGO:<br>35205 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>27393 LBS<br><br>DEPLOYED:<br>1104 LBS<br><br>NON-DEPLOYED:<br>23586 LBS<br><br>MIDDECK:<br>866 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>819825 LBS<br>NON-DEPLOYED:<br>1089758 LBS<br>CARGO TOTAL:<br>2311537 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3080<br>FUEL BIAS: 900<br>FINAL TDDP: 5381<br>RECON: 8528<br><br>PAYLOADS:<br>PLB:<br>SPACEHAB-4<br>SPARTAN 207/IAE<br>TEAMS (GANE,<br>LMTE, VTRE,<br>PAMS/STU<br>(deployed))<br>GBA (12<br>BETSCE<br><br>MIDDECK:<br>ARF-01<br>BRIC-07<br><br>5 CRYO TK SETS<br><br>RMS 45<br>(S.N. 301)<br><br>RMS used for<br>SPARTAN 207<br>deploy, retrieve, and<br>berth (IAE deployed<br>from SPARTAN). | KSC W/D: OPF 69, VAB 5, PAD 27 = 101 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 4/25/96 on 6/19/95.<br>- Postponed launch date to 5/16/96 on 9/11/95.<br>- Postponed launch date to 5/19/96 on 5/14/96 (Atlas launch had range priority).<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH DELAYS: None.<br><br>TAL WX:<br>- BEN (prime) was forecast NO-GO for broken ceiling but observed GO at TAL landing time. MRN was forecast GO, selected, and observed GO. ZZA was forecast GO but observed NO-GO for broken ceiling at TAL landing time.<br><br>DOLILU-II I-LOADS:<br>- DOLILU-II uplink #8, I-load uplink #27.<br><br>FLIGHT DURATION CHANGES: None. Flight was planned to be 10 days assuming 5/19/96 liftoff; hence, this does not count as a flight duration change.<br><br>FIRSTS/LASTS:<br>- First flight with all 3 Block I engines.<br>- First flight to be controlled completely from the new MCC (White FCR).<br><br>EVENTS:<br>- SPARTAN deployed at 1:01:59:12 MET.<br>- SPARTAN grappled at 2:04:22:34 MET and berthed at 2:05:25:41 MET.<br>- PAMS/STU deployed at 2:22:50:00 MET.<br><br>RENDEZVOUS #28: Rendezvous, capture, and berth (return) of SPARTAN-207).<br><br>RENDEZVOUS #29, #30, & #31:<br>Rendezvous & PROXIMOUS OPS with PAMS/STU payload.<br><br>"STS-77 still holds the record for most number of rendezvous operations of any space flight"- From Wayne Hale's blog:<br><a href="http://blogs.nasa.gov/cm/newui/blog/viewpostlist.jsp?blogname=waynehalesblog">http://blogs.nasa.gov/cm/newui/blog/viewpostlist.jsp?blogname=waynehalesblog</a> - "My Favorite Shuttle Flight" posted May 26, 2010.<br><br>SIGNIFICANT ANOMALIES:<br>- IPS file server (MPSR1) disk crash prelaunch.<br>- FES failure to come out of standby.<br>- PCS 1 O <sub>2</sub> supply transducer failed.<br>- WSB 2 failed to cool during ascent.<br>- APU 2 fuel pump seal cavity drain line pressure decay.<br>- WSB 3 overcool during entry.<br>- RCS jet F2F fail leak (oxidizer leak).<br>- RCS jet R3A heater failed off. |



s77e5053-- RMS holds Spartan 207 free flyer above PLB. SPACEHAB is in foreground.





STS077-314-011 Inflight crew portrait. Left to right, front: Thomas/MS, CDR Casper and Runco/MS. Back row: PLT Brown, Garneau /MS/CSA & Bursc/MS.



s77e5053-- RMS holds Spartan 207 free flyer above PLB. SPACEHAB is in foreground.




STS077-314-011 Inflight crew portrait. Left to right, front: Thomas/MS, CDR Casper and Runco/MS. Back row: PLT Brown, Garneau /MS/CSA & Bursch/MS.

## Page 2-94 - STS-78

[illegible]





## Page 2-95 - STS-79

| FLT  | ORBITER                                    | CREW<br>(7)<br>6 UP / 6 DOWN  | LAUNCH SITE,<br>LIFTOFF TIME,  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE   | SSME-TL<br>NOM-ABORT<br>EMERG  | SRB<br>RSRM   | ORBIT        |   | FSW  | PAYLOAD WEIGHTS,   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,                         |  |  |
|--|--|---|--|--|--|---|--------------|---|--|--|--|--|--|
| NO.  |  | TITLE, NAMES<br>& EVA'S   | LANDING SITES,<br>ABORT TIMES  | LANDING TIMES<br>FLT DURATION,<br>WINDS  | THROTTLE<br>PROFILE<br>ENG. S.N.   | AND<br>ET   | INC          | HA/HP   |  | PAYLOADS/<br>EXPERIMENTS   | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |  |
| STS-79   | OV-104<br>(Flight 17)<br>Atlantis          | CDR:<br>William F. Ready<br>(Flt 3 - STS-42, STS-51)<br>P449/R140/V96/M125  | KSC PAD 39A<br>260:08:54:48.96Z<br>(4:54:49 AM EDT (P)<br>4:54:49 AM EDT (A)<br>Monday 11<br>9/16/96 (8)   | KSC 15 (KSC 32)<br>270:12:13:13Z<br>8:13:13 AM EDT<br><br>Thursday 8<br>9/26/96 (9)  | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104/<br>67/104<br><br>ACTUAL:<br>100/104/104<br>67/104<br><br>1 = 2012 (18)<br>2 = 2031 (14)<br>3 = 2033 (8) | BI-083<br><br>RSRM<br>56<br><br>ET-82<br><br>LWT<br>75<br><br>ET<br>PRED<br>RPT:<br>271.3K<br><br>ET<br>BRKUP:<br>214K<br><br>ET<br>IMPACT<br>1:26:47<br>MET<br>LAT:<br>0.65°S<br>LONG:<br>125.96°W | 51.67<br>(5) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>158.6 X 85.3<br>NM<br><br>NC6:<br>2:14:05:33 MET<br>203.7 X 201<br>NM<br><br>NC2:<br>2:15:38:10 MET<br>208.8 X 201.9<br>NM<br><br>SEP BURN:<br>7:16:49:15 MET<br>211 X 201.3<br>NM<br><br>DEORBIT:<br>209.1 X 197.7<br>NM<br><br>VELOCITY:<br>25892 FPS<br><br>ENTRY<br>RANGE:<br>4276 NM | OI-25<br>(1)<br><br>CARGO:<br>27812 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>19039 LBS<br><br>DEPLOYED:<br>3170 LBS<br><br>NON-DEPLOYED:<br>15151 LBS<br><br>MIDDECK:<br>718 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>822995 LBS<br>NON-DEPLOYED:<br>1129291 LBS<br>CARGO TOTAL:<br>2371203 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 4456<br>FUEL BIAS: 432<br>FINAL TDDP: 462<br>RECON: 716<br><br>PAYLOADS:<br>PLB:<br>SHUTTLE/MIR<br>MISSION 4<br>SPACEHAB 5<br>(DOUBLE MODULE)<br>ODS<br><br>MIDDECK:<br>SAREX<br>IMAX<br>MSX<br>CPCG<br>MGM<br>SAMS<br>CGBA<br>MGBX<br><br>5 CRYO TK SETS<br>4 GN <sub>2</sub> TANKS<br><br>NO RMS | KSC W/D: OPF 73 (2), VAB 17 (3), PAD 25 (3) = 115 days total<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline 8/1/96 launch date on 5/4/95.<br>- 5/4/95 launch date was postponed when the shuttle was rolled back from pad A to VAB on 7/10/96 under threat from Hurricane Bertha.<br>- Due to STS-78 booster sooting and heat effects in field joints, decision was made to restack using STS-80 SRB's (and ET) which used old process. Set launch date to 9/12/96.<br>- Rolled out to pad A on 8/30/96.<br>- Rolled back to VAB 9/4/96 under threat of Hurricane Fran. Postponed launch to 9/16/96. Rolled to pad on 9/6/96.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH DELAYS: None<br><br>LAUNCH WINDOW:<br>- Mir rendezvous planar/phase window was 7M00S; however, it was limited to 5M47S due to a negative performance margin (-523 lbs) at window opening. Liftoff was delayed (per plan) for 36 seconds for zero performance margin plus an additional 10 seconds (total delay 46 seconds) which allowed approx + 200 lbs APM (wind, loads allowance).<br><br>SHUTTLE NIGHT LAUNCH #14<br><br>DOLILU-II I-LOADS: DOLILU-II uplink #10, I-load uplink #29.<br><br>FLIGHT DURATION CHANGES: Extended 1 day for additional science.<br><br>FIRSTS:<br>- First U.S. spaceflight with female flight director for entry/ landing (Linda Ham).<br><br>RENDEZVOUS #32: Rendezvous and dock with Mir (fourth docking).<br><br>EVENTS:<br>- Shannon Lucid was carried to Mir 21 on STS-76 and was replaced on Mir 22 by John Blaha on this flight.<br>- Shannon Lucid's total flight time: 188:04:00:09 and total Mir time: 178:22:23:45.<br>- Docking complete at 263:03:21:20Z, 2:18:26:31 MET.<br>- Transferred 2025 lbm H <sub>2</sub> O, 69 lbm O <sub>2</sub> , and 43 lbm N <sub>2</sub> to Mir.<br>- At 3:02:11 MET, Shannon Lucid transferred to STS-79 and John Blaha transferred to Mir-22 crew. (263:11:05:49Z)<br>- Undocking at 268:01:31:29Z, 07:16:36:40 MET.<br><br>RADIATOR DEPLOY #19:<br>- Both port and starboard radiators were deployed for cooling and to conserve water for transfer to Mir.<br>- Transferred 20 CWC's with 2025 lbs water.<br><br>Continued ... |  |  |  |
| SEQ<br>FLT #79   | Spacehab 5                                 | PLT:<br>Terrence W. Wilcutt<br>(Flt 2 - STS-68)<br>P450/R183/V130/M160  | LAUNCH WINDOW:<br>5:47M<br>MIR PLANAR/<br>PHASE WINDOW<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN   | DEORBIT BURN:<br>270:11:06:14Z<br><br>XRANGE: 777 NM<br><br>ORBIT DIR: DR 19<br><br>AIM PT: CLOSE IN   | M 3 EOM:<br>WEIGHT:<br>215990 LBS<br>X CG:<br>1081.31<br><br>LANDING:<br>WEIGHT:<br>215904 LBS<br>X CG:<br>1083.02   |   |              |   |  |  |  |  |  |
| KSC-79   |  | M/S 1:<br>Jay Apt<br>(Flt 4 - STS-37, STS-47,<br>STS-59)<br>P451/R123/V79/M110  | SELECTED:<br>RTLS: KSC 33/N/SF<br>TAL: ZZA 30/N/SF<br>AOA: KSC 15/C/I/N<br>PLS: EDW 22/N/N<br><br>TDEL:<br>0.06    -0.018/0.02<br><br>MAX Q NAV:<br>697                 705<br><br>SRB STG:<br>2:02.4                 2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA):<br>2:38                 2:35<br><br>NEG RETURN:<br>4:06                 4:03<br><br>PTA (U/S 260):<br>4:46                 4:48<br><br>PTM (U/S 260):<br>5:20                 5:24<br><br>DROOP (BYD):<br>5:28                 5:28<br><br>MECO CMD:<br>8:33                 8:34.6<br><br>VI:<br>25878                 25880<br><br>OMS-2:<br>42:50.9                 42:50.9<br>75.9 FPS                 75.9 FPS<br>00:47                 00:47 | MLGTD: 807 FT<br>270:12:13:13Z<br>VEL:    217 KGS<br>HDOT:    -4.3 FPS<br><br>TD NORM 195:<br>2496 FT<br><br>DRAG CHUTE<br>DEPLOY: 192 KEAS<br>270:12:13:22Z<br><br>NLGTD: 5760 FT<br>270:12:13:29Z<br>VEL:    150 KGS<br>HDOT:    -4.2 FPS<br><br>BRK INIT: 89 KGS<br><br>DRAG CHUTE<br>JETTISON: 55 KGS<br>270:12:13:57Z<br><br>AVE BRK DECEL:<br>3.1FPS/S<br><br>WHEELS STOP:<br>270:12:14:34Z<br>11788 FT<br><br>ROLLOUT:<br>10981 FT<br>81 SEC<br><br>WINDS:<br>H4, L3 KTS<br>OFFICIAL: 1206P09<br>H5, L3 |  |   |              |   |  |  |  |  |  |
| PAD<br>39A-45  | OMS PODS:<br>LPO3-21<br>RPO4-17<br>FRC4-17 | M/S 2:<br>Thomas D. Akers<br>(Flt 4 - STS-41, STS-49,<br>STS-61)<br>P452/R115/V74/M103  |  |  |  |   |              |   |  |  |  |  |  |
| MLP-1  |  | M/S 3:<br>Carl E. Walz<br>(Flt 3 - STS-51, STS-65)<br>P453/R170/V106/M148<br><br>M/S 4:<br>Ascent<br>John E. Blaha<br>(Flt 5 - STS-29, STS-33,<br>STS-43, STS- 58, stay on<br>Mir 22, and return on<br>STS-81)<br>P454/R97/V48/M88<br><br>M/S 4:<br>Descent<br>Shannon Lucid<br>(Flt 5 - STS-51-G, STS-34,<br>STS-43, STS-58, Ascent<br>on STS-76, on-orbit stay<br>on Mir 21 and Mir 22)<br>P455/R65/V45/F6<br><br>MCC WHITE FCR (9)<br><br>FLIGHT DIRECTORS:<br>ASC - R. D. Jackson<br>ENT- L. J. Ham<br>LD/O 1 - P. F. Dye<br>O 2 - R. E. Castle<br>PLNG - W. D. Reeves<br>MOD - A. L. Briscoe |  |  |  |   |              |   |  |  |  |  |  |
|  |  |   |  |  |  |   |              |   |  |  |  |  |  |
| NM22-427-023 --- STS-79 Atlantis as seen on approach to MIR.                         |  |   |  |  |  |   |              |   |  |  |  |  |  |





# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-96 - STS-79

| FLT NO.   | ORBITER | CREW (6)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.                  | SRB<br>RSRM<br>AND<br>ET  | ORBIT   |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFIC:T ANOMALIES, ETC.) |
|---|---------|--------------------------------------|---|--|--|---|---|--|-----|--|---|
| STS-79<br><br>Continued   |         |                                      |   | Continued . . .<br><br><u>DENS ALT:</u> 1084 FT<br><br><u>FLT DURATION:</u><br>10:03:18:24<br><br><u>S/T:</u> 641:13:48:49<br><br><u>OV-104:</u><br>120:16:54:18<br><br><u>DISTANCE:</u><br>3,900,000 sm |  |   | STS079-349-022 --- Inflight crew portrait, in Mir: Front row, left to right, Aleksandr Y. Kaleri/MIR, Apt, Blaha, Readdy, & Lucid. Back row, left to right, Akers, Walz, Valeri G. Korzun/MIR, Wilcutt. |  |     | Continued . . .<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- RH RSRM nozzle erosion beginning in throat ring and extending aft into forward exit cone (approx 60 longitudinal erosion areas up to 0.4 inch diameter).<br>- Supply water tank B quantity transducer dropouts.<br>- Fuel cell O <sub>2</sub> flow transducer degraded.<br>- Cryo H <sub>2</sub> tank 3 B heater failure.<br>- Single string GPS erroneous time reference, loss of lock and runaway. (Firmware problem.)<br>- TCS range discrepancy.<br>- APU 2 underspeed shutdown at 13:14 MET. Two-APU entry/landing.<br>- APU 2 fuel pump seal cavity drain line pressure decay to vacuum. |   |
|  |         |                                      |   |  |  |  |   |  |     |    | STS079-810-028 --- Russia's Mir Space Station as seen after undocking.  |
|   |         |                                      |   |  |  |   |   |  |     |  |   |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-97 - STS-80

| FLT NO.  | ORBITER   | CREW (5)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT  |   | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|---|--|--|--|---|--|---|---|--|---|
| STS-80<br><br>SEQ FLT #80<br><br>KSC-80<br><br>PAD 39B-35<br><br>MLP-3   | OV-102 (Flight 21 Columbia)<br><br>EDO 9<br><br>OMS PODS: LPO5-10 RPO1-25 FRC2-21 | CDR: Kenneth D. Cockrell (Flt 3 - STS-56, STS-69) P456/R159/V121/M140<br><br>PLT: Kent V. Rominger (Flt 2 - STS-73) P457/R200/V131/M174<br><br>M/S 1 (EV1): Tamara E. Jernigan (Flt 4 - STS-40, STS-52, STS-67) P458/R130/V83/F14<br><br>M/S 2 (EV2): Thomas D. Jones (Flt 3 - STS-59, STS-68) P459/R177/V111/M155<br><br>M/S 3: F. Story Musgrave (Flt 6 - STS-6, STS 51-F, STS-33, STS-44, STS-61) P460/R15/V19/M15<br><br>Two 6-hour EVA's planned by Jernigan (EV1) and Jones (EV2) for EDFT. EVA's were canceled when crew could not get "B" hatch open. | KSC PAD 39B<br>324:19:55:46.95Z<br>2:53:00 PM EST (P)<br>2:55:47 PM EST (A)<br>Tuesday 10<br>11/19/96 (11)<br><br>LAUNCH WINDOW: 2H30M CTOB<br><br>EOM PLS: KSC<br>TAL: BEN<br>TAL WX: MRN<br><br>SELECTED: RTLS: KSC15/N/N<br>TAL: BEN36/N/N<br>AOA: EDW22/N/N<br>PLS: EDW22/N/N<br><br>TDEL: -0.04 -0.238/-0.2<br><br>MAX Q NAV: 717 719<br><br>SRB STG: 2:04.3 ~2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN): 3:03 3:03<br><br>NEG RETURN: 3:58 3:59<br><br>PTA (U/S 304): 4:55 4:51<br><br>DROOP (BYD): 5:28 5:28<br><br>PTM (U/S 304): 5:57 5:55<br><br>MECO CMD: 8:29.9 8:30.4<br><br>VI: 25922 25915<br><br>OMS-2: 40:24 40:24<br>279 FPS 279 FPS | KSC 33 (KSC 33)<br>342:11:49:04Z<br>6:49:04 AM EST<br><br>Saturday 17<br>12/7/96 (8)<br><br>DEORBIT BURN: 342:10:48:02Z<br><br>XRANGE: 72 NM<br><br>ORBIT DIR: DL 37<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3068 FT<br>342:11:49:04Z<br>VEL: 210 KGS<br>203 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 205: 3063 FT<br><br>DRAG CHUTE DEPLOY: 193 KEAS<br>342:11:49:08Z<br><br>NLGTD: 7100 FT<br>342:11:49:17Z<br>VEL: 149 KGS<br>HDOT: -5.5 FPS<br><br>BRK INIT: 121 KGS<br><br>DRAG CHUTE JETTISON: 54 KGS<br>342:11:49:40Z<br><br>BRK DECEL FPS <sup>2</sup> : AVE 5.1 PK 7.6<br><br>WHEELS STOP: 342:11:50:13Z<br>11789 FT<br><br>ROLLOUT: 8721 FT<br>69 SEC<br><br>WINDS: 2T, 4L KTS<br>OFFICIAL: 2006P9<br>4T, 4L<br><br>DENS ALT: 522 FT<br><br>FLT DURATION: 17:15:53.17<br><br>S/T: 659:05:42:06<br><br>OV-102: 217:16:58:27<br><br>DISTANCE: 7,043,950 Sm | 104/104/<br>109%<br><br>PREDICTED: 100/104/104/<br>67/104<br><br>ACTUAL: 100/104/104/<br>67/104<br><br>1 = 2032 (5)<br>2 = 2026 (6)<br>3 = 2029 (14)<br><br>M 3 EOM: WEIGHT: 227815 LBS<br>X CG: 1079.10<br><br>LANDING: WEIGHT: 227670 LBS<br>X CG: 1080.62 | BI-084<br><br>RSRM<br>49<br><br>ET-80<br><br>LWT 73<br><br>ET<br>PRED RPT: 271.3K<br><br>ET<br>BRKUP: 214K<br><br>ET<br>IMPACT 1:22:40<br>MET<br>LAT: 15.5°N<br>LONG: 159.6°W | 28.45<br>(42)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2: 190 X 188 NM<br><br>DEORBIT: 203 X 169 NM<br><br>VELOCITY: 25877 FPS<br><br>ENTRY RANGE: 4346 NM | OI-25<br>(2)<br><br>CARGO: 31111 LBS<br><br>PAYLOAD CHARGEABLE: 21208 LBS<br><br>DPLY/RETRIEVE: 12524 / 12427 LBS<br><br>NON-DEPLOYED: 7575 LBS<br><br>MIDDECK: 1109 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 822995 LBS<br>NON-DEPLOYED: 1137975 LBS<br>CARGO TOTAL: 2402314 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3100<br>FUEL BIAS: 884<br>FINAL TDDP: 486<br>RECON: 1102<br><br>PAYLOADS: PLB: ORFEUS-SPAS (Astronomical observations)<br>WSF-3 (Epitaxial semiconductor) SEM<br><br>MIDDECK: PARE/NIH-R<br>CMIX<br>VIEW-CPL<br>CCM-A, BRIC, MSX<br><br>5 CRYO TK SETS + 4 EDO & 5 N2 TANKS<br><br>EDO PALLET<br><br>RMS 46 (S.N. 202))<br>RMS used for ORFEUS-SPAS de-<br>ploy, grapple & berth<br>and WSF de-<br>ploy, grapple & berth and<br>EDFT-05 | KSC W/D: OPF 80, VAB 6, PAD 33 = 119 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 11/7/96 on 7/14/95.<br>- Advanced launch date to 10/31/96 on 4/23/96.<br>- Postponed launch date to 11/8/96 on 9/20/96 to analyze implications of STS-79 RH SRM nozzle erosion.<br>- Postponed launch date to 11/15/96 to allow Thiokol time to complete SRM analysis.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 11/15/96 launch date after L-2 MMT on 11/13/96 due to forecast of high surface winds at KSC from 11/15/96 through 11/18/96. New launch date of 11/19/96.<br><br>LAUNCH DELAYS:<br>- Launch delayed 2M47S at T-31 secs while measuring H2 gas in aft compartment per preplanned procedure to confirm <600 ppm.<br><br>TAL WX:<br>- Ben Guerir (prime and selected) was forecast and observed GO. Moron was forecast and observed NO-GO for 300 ft overcast. Banjul was not available.<br><br>DOLILU-II I-LOADS:<br>- DOLILU-II uplink #12, I-Load uplink #30.<br><br>FLIGHT DURATION CHANGES:<br>- Extended a day for science, then changed to original landing day due to weather at KSC. Waved off landing at KSC on orbits 248 and 249 (broken ceiling). Waved off landing on orbits 264 and 265 due to forecast and observed ground fog. Total extension of 2 days.<br><br>RENDEZVOUS #33: Rendezvous, deploy, grapple, berth and return ORFEUS-SPAS.<br><br>RENDEZVOUS #34: Rendezvous, deploy, grapple, berth and return WSF-3.<br><br>FIRSTS/LASTS:<br>- First flight with two free-flyers (ORFEUS-SPAS and WSF) and orbiter in constrained motion.<br><br>EVENTS:<br>- ORFEUS-SPAS deployed by RMS at 325:04:10:50Z, 08:15:03 MET.<br>- SEP 1 maneuver at 325:04:11:48Z, SEP 2 at 325:04:44:11Z.<br>- WSF-3 deployed by RMS at 328:01:37:40Z, 03:05:41:53 MET.<br>- WSF-3 grappled, berthed at 331:02:33:51Z, 06:06:38:04 MET.<br>- Crew attempted opening "B" hatch at 334:02:30Z, 09:06:34 MET. Being unsuccessful, the two EVA's were canceled.<br>- ORFEUS-SPAS grappled at 339:08:25:47Z; berthed at 339:13:03:41Z.<br><br>SIGNIFICANT ANOMALIES:<br>- Loss of LMG down indications.<br>- Crew unable to unlatch and open "B" hatch (outer airlock). Crew able to turn handle only 30 degrees. Resulted in cancellation of two EVA's. Found screw backed out and in latch actuator planetary gears.<br>- Window W8 impact damage.<br>- IMU 1 BITE annunciations (deselected from selection filter for entry.)<br>- EV2 helmet difficult to latch. |  |   |
| STS080-310-028 --<br>- Musgrave photographs Wake Shield Facility during free flight mode with 600mm camera.  |   |   |  |  |  |   |  |   |   |  |   |
|    |   |   |  |  |  |   |  |   |   |  |   |
|    |   |   |  |  |  |   |  |   |   |  |   |
| <div>STS080-701-004 -- Middeck inflight crew portrait. Back row, left to right, CDR Cockrell, Jernigan/MS, &amp; PLT Rominger. Front row, Jones/MS (left) &amp; Musgrave/MS.</div> |   |   |  |  |  |   |  |   |   |  |   |



STS080-310-028 --  
- Musgrave  
photographs Wake  
Shield Facility  
during free flight  
mode with 600mm  
camera.



STS080-701-004 -- Middeck inflight crew portrait. Back row, left to right, CDR Cockrell, Jernigan/MS, & PLT Rominger. Front row, Jones/MS (left) & Musgrave/MS.



## Page 2-98 - STS-81

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-99 - STS-82

| FLT NO.  | ORBITER  | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET   | ORBIT INC HA/HP  |  | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|---|--|--|---|---|--|--|--|--|---|
| STS-82<br>SEQ<br>FLT #82<br>KSC-82<br>PAD<br>39A-46<br>MLP-1 | OV-103<br>(Flight 22)<br>Discovery<br><br>OMS PODS:<br>LPO1-25<br>RPO3-23<br>FRC3-22 | CDR:<br>Kenneth D. Bowersox<br>(Flt 4 - STS-50, STS-61,<br>STS-73)<br>P468/R146/V97/M130<br><br>PLT:<br>Scott J. (Doc) Horowitz<br>(Flt 2 - STS-75)<br>P469/R210/V135/M183<br><br>M/S 1/EV-4<br>Joseph R. Tanner<br>(Flt 2 - STS-66)<br>P470/R185/V136/M162<br><br>M/S 2:<br>Steven A. Hawley<br>(Flt 4 - STS 41-DR,<br>STS 61-C, STS-31)<br>P471/R39/V29/M38<br><br>M/S 3/EV-3:<br>Gregory J. Harbaugh<br>(Flt 4 - STS-39, STS-54,<br>STS-71)<br>P472/R125/V88/M112<br><br>M/S 4/EV-1:<br>Mark C. Lee<br>(Flt 4 - STS-30, STS-47,<br>STS-64)<br>P473/R100/V78/M91<br><br>M/S 5/EV-2:<br>Steven L. Smith<br>(Flt 2 - STS-68)<br>P474/R184/V137/M161 | KSC 39A<br>42:08:55:16.98Z<br>3:55:17 AM EST (P)<br>3:55:17 AM EST (A)<br>Tuesday 11<br>2/11/97 (6)<br><br>LAUNCH WINDOW:<br>1H6M30S<br>HST PLANAR/<br>PHASE WINDOW<br><br>EOM PLS: KSC<br>TAL: BEN<br>TAL WX: NONE<br><br>SELECTED:<br>RTL: KSC 15/N/N<br>TAL: NONE<br>AOA: KSC 15/N/N<br>PLS: KSC 22/N/N<br><br>TDEL:<br>-0.01 0.312/0.35<br><br>MAX Q NAV:<br>745 PSF 754 PSF<br><br>SRB STG:<br>2:04.3 2:05<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>NO CALL<br><br>NEG RETURN:<br>4:04 4:05<br><br>PTA (U/S 500):<br>3:56 3:51<br><br>DROOP:<br>5:27 5:25<br><br>PTM (U/S 500):<br>5:14 5:04<br><br>MECO CMD:<br>8:30.1 8:29.8<br><br>VI:<br>26129 26119<br><br>OMS-2:<br>44:29.6 44:33.6<br>273.8 FPS 276 FPS | KSC 15 (KSC 35)<br>52:08:32:24Z<br>3:32:24 AM EST<br><br>Friday 9<br>2/21/97 (4)<br><br>DEORBIT BURN:<br>52:07:21:55Z<br><br>XRANGE: 484 NM<br><br>ORBIT DIR: DL 39<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 2522 FT<br>52:08:32:24Z<br>VEL: 184 KGS<br>191 KEAS<br>HDOT: -1.5 FPS<br><br>TD NORM 195:<br>2394 FT<br><br>DRAG CHUTE<br>DEPLOY: 184 KEAS<br>52:08:32:27Z<br><br>NLGTD: 5581 FT<br>52:08:32:34Z<br>VEL: 136 KGS<br>140 KEAS<br>HDOT: -6.7 FPS<br><br>BRK INIT: 94 KGS<br><br>DRAG CHUTE<br>JETTISON: 52 KGS<br>52:08:32:56Z<br><br>BRK DECEL FPS2:<br>AVE 5.2 PK 7.7<br><br>WHEELS STOP:<br>52:08:33:16Z<br>9588 FT<br><br>ROLLOUT:<br>7066 FT<br>52 SEC<br><br>WINDS:<br>5H, 1L KTS<br>OFFICIAL:1407P13<br>7H, 1L<br><br>Continued . . . | 104/104/<br>109%<br><br>PREDICTED:<br>100/100/100/<br>67/104<br><br>ACTUAL:<br>100/100/100/<br>68/104<br><br>1 =2037 (3)<br>2 =2040 (2)<br>3 =2038 (3)<br><br>M 3 EOM:<br>AVE<br>WEIGHT:<br>213949 LBS<br>X CG:<br>1077.83<br><br>LANDING:<br>WEIGHT:<br>213869 LBS<br>X CG:<br>1079.57 | BI-085<br><br>RSRM<br>58<br><br>ET-81<br><br>LWT-74<br><br>ET<br>PRED<br>RPT:<br>271.3K<br><br>ET<br>BRKUP:<br>214K<br><br>ET<br>IMPACT<br>1:29:22<br>MET<br>LAT:<br>17.4°N<br>LONG:<br>141.1°W | 28.46<br>(43)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>312.9 X 186.3<br>NM<br><br>FINAL<br>BRAKES:<br>322.3 X 316.4<br>NM<br><br>REBOOST 1:<br>323.7 X 319.2<br>NM<br><br>REBOOST 1A:<br>325.4 X 320.0<br>NM<br><br>REBOOST 2:<br>328.9 X 320.5<br>NM<br><br>REBOOST 3:<br>335.1 X 321.0<br>NM<br><br>DEORBIT:<br>334.1 X 312.2<br>NM<br><br>DEORBIT<br>BURN:<br>504 FPS<br><br>VELOCITY:<br>26120 FPS<br><br>ENTRY<br>RANGE:<br>4238 NM | 01-25<br>(4)<br><br>CARGO:<br>24891 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>17374 LBS<br><br>DEPLOYED:<br>6941 LBS<br><br>NON-DEPLOYED:<br>9921 LBS<br><br>MIDDECK:<br>512 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>833955 LBS<br>NON-DEPLOYED:<br>1163710 LBS<br>CARGO TOTAL:<br>2455354 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3100<br>FUEL BIAS: 884<br>FINAL TDDP:3503<br>RECON:4235<br><br>PAYLOADS:<br>PLB:<br>Hubble Space<br>Telescope Service<br>Mission 2<br>(HST SM-02)<br><br>MIDDECK:<br>MSX<br><br>5 CRYO TK SETS +<br>5 N2 TANKS<br><br>RMS 47<br>(S.N. 301)<br><br>RMS USED FOR<br>HST CAPTURE,<br>BERTH, & DEPLOY | KSC W/D: OPF 147, VAB 5, PAD 26 = 178 days total.<br><br>LAUNCH ADVANCEMENTS:<br>- Baselined 2/13/96 launch date on 10/27/96.<br>- Advanced launch date to 2/11/97 on 1/15/97.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH DELAYS: None<br><br>TAL WX:<br>- Only Ben Guerir was manned; however, Ben Guerir was NO-GO for ceiling and visibility (overcast 500 feet and ground fog). There was no requirement for a TAL site due to a planned 8-second overlap between RTLS and PTA (actual overlap 14 seconds).<br><br>DOLILU-II I-LOADS:<br>- DOLILU-II uplink #13, I-Load uplink #32<br><br>SHUTTLE NIGHT LAUNCH #16<br><br>FLIGHT DURATION CHANGES:<br>- Waved off landing at KSC on orbit 149 due to clouds forming over runway with chance of 3000 feet broken. Landed on orbit 150.<br>- Extended flight duration 1 rev.<br><br>SHUTTLE NIGHT LANDING #9<br><br>FIRSTS/LASTS:<br>- First night landing at KSC with centerline lights.<br><br>EVENTS:<br>- HST grapple at 1:23:38 MET<br>- Space Shuttle altitude record 335.1 NM X 321.0 NM after Reboost 3 maneuver.<br><br>RENDEZVOUS #36:<br>- Rendezvous, grapple, service, reboost, and release of HST.<br><br>HST REBOOST MANEUVERS:<br>- Reboost 1 was 20M43S at 04:01:09:28 MET.<br>- Reboost 1A was 10M13S at 04:06:07:02 MET with delta V 33 FPS. Maneuver was to avoid a conjunction with Pegasus debris.<br>- Reboost 2 was 19M47S at 05:01:15:00 MET.<br>- Reboost 3 was 31M54S at 07:01:32:58 MET.<br><br>SIGNIFICANT ANOMALIES:<br>- HST + V2 solar array rapid slew during airlock depress. For subsequent airlock depresses, one equalization valve on each hatch was duct-taped to limit air flow.<br>- EMU gloves had yellow smudges from HST handrails.<br>- FES feedline A accumulator heater failure.<br>- Erratic supply water tank D transducer. |  |   |

Continued . . .


STS082-E-5147  
Captured HST







Continued . . .

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-100 - STS-82

| FLT NO.                 | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET | ORBIT<br><br>INC<br>HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFIC: T ANOMALIES, ETC.)  |
|-------------------------|---------|---|--|--|--|--------------------------|---------------------------|--|-----|---|---|
| STS-82<br><br>Continued |         | <u>Continued</u> . . .<br><br>SS EVA #34<br>EMU/tethered EVA 1<br>by EV1 and EV2 on 2/13/97<br>Scheduled EVA #30<br>6H42M21S duration<br><br>SS EVA #35<br>EMU/tethered EVA 2<br>by EV3 and EV4 on 2/14/97<br>Scheduled EVA #31<br>7H27M31S duration<br><br>SS EVA #36<br>EMU/tethered EVA 3<br>by EV1 and EV2 on 2/15/97<br>Scheduled EVA #32<br>7H11M00S duration<br><br>SS EVA #37<br>EMU/tethered EVA 4<br>by EV3 and EV4 on 2/16/97<br>Scheduled EVA #33<br>6H34M30S duration<br><br>SS EVA #38<br>EMU/tethered EVA 5<br>by EV1 and EV2 on 2/17/97<br>Unscheduled EVA #5<br>5H17M21Sduration<br><br><br>MCC WHITE FCR (12)<br><br>FLIGHT DIRECTORS:<br>A/E - N. W. Hale<br>LD/O 1 - J. W. Bantle<br>O 2 - B. P. Austin<br>PLNG - C. W. Shaw<br>MOD - A. L. Briscoe |  | <u>Continued</u> . . .<br><br>DENS ALT: 926 FT<br><br>FLT DURATION:<br>9:23:37:07<br><br>S/T: 679:10:14:34<br><br>OV-103:<br>155:23:27:01<br><br>DISTANCE:<br>3,800,000 sm | <br>S82E5948 1997-02-19 11:04:53 |                          |                           |  |     |   | <u>Continued</u> . . .<br><br>SIGNIFICANT ANOMALIES (CONTINUED):<br>- Fuel cell 3 water flow through alternate path causing concern that H <sub>2</sub> gas would get into EMU's during recharge from tank C.<br>- Bent pins on SADE-2R P2 harness.<br>- Three PGSC problems.<br>- No RSRM erosion found. |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   |  |  |  |                          |                           |  |     |   |   |
|                         |         |   | </                                     |  |  |                          |                           |  |     |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER                     | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM<br><br>AND ET  | ORBIT  |  | FSW  | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|-----------------------------|---|--|---|---|---|--|--|--|---|---|
| STS-83   | OV-102 (Flight 22) Columbia | CDR: James D. Halsell, Jr. (Flt 3 - STS-65, STS-74) P475R178/V123/M156<br><br>PLT: Susan L. Still P476/R218/F28<br><br>M/S 1 (PAYLOAD CDR): Janice E. Voss (Flt 3 - STS-57, STS-63) P477/R167/V115/F22<br><br>M/S 2: Michael L. Gernhardt (Flt 2 - STS-69) P478/R199/V138/M173<br><br>M/S 3: Donald A. Thomas (Flt 3 - STS-65, STS-70) P479/R180/V119/M158<br><br>P/S 1: Roger Crouch P480/R219/M191<br><br>P/S 2: Gregory T. Linteris P481/R220/M192<br><br>MCC WHITE FCR (13) FLIGHT DIRECTORS: A/E - L. J. Ham LD/O 3 - R. M. Kelso O 1 - W. D. Reeves O 2 - G. A. Pennington O 4 - J. P. Shannon MOD - J. W. Bantle | KSC, PAD 39A 94:19:20:31.98Z 2:00:00 PM EST (P) 2:20:32 PM EST (A) Friday 16 4/4/97 (12)<br><br>LAUNCH WINDOW: 2H30M CTOB<br><br>EOM PLS: KSC TAL: BYD TAL WX: BEN, MRN<br><br>SELECTED: RTLS: KSC 15/N/N TAL: BYD 32/N/N AOA: KSC 15/N/N PLS: FD1 NONE FD2 DELAY PRESS 12 SECONDS<br><br>TDEL: 0.01 0.012/0.05<br><br>MAX Q NAV: 709 708<br><br>SRB STG: 2:03.5 2:03<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BYD): 2:40 2:41<br><br>NEG RETURN: 3:57 4:00<br><br>PTA (U/S 154): 5:21 5:16<br><br>DROOP (BYD): 5:29 5:30<br><br>PTM (U/S 243): 5:45 5:45<br><br>MECO CMD: 8:29.7 8:30.7<br><br>VI: 25877 25871<br><br>OMS-2: 39:53 39:54.7 221.6FPS 222 FPS | KSC 33 (KSC 36) 94:18:33:11Z 2:33:11 PM EDT Tuesday 12 4/8/97 (10)<br><br>DEORBIT BURN: 98:17:31:18Z<br><br>XRANGE: 56 NM<br><br>ORBIT DIR: DL 40<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3127 FT 98:18:33:11Z VEL: 193 KGS 197 KEAS HDOT: -1.3 FPS<br><br>TD NORM 205: 2553 FT<br><br>DRAG CHUTE DEPLOY: 186 KEAS 98:18:33:15Z<br><br>NLGTD: 6654 FT 98:18:33:23Z VEL: 145 KGS 151 KEAS HDOT: -5.8 FPS<br><br>BRK INIT: 85 KGS<br><br>DRAG CHUTE JETTISON: 57 KGS 98:18:33:48Z<br><br>BRK DECELFPS: AVE 4.8 PK 6.9<br><br>WHEELS STOP: 98:18:34:11Z 11729 FT<br><br>ROLLOUT: 8602 FT 60 SEC<br><br>WINDS: H10, R2 OFFICIAL: 0209P18 H6, R6<br><br>DENS ALT: 963 FT<br><br>FLT DURATION: 3:23:12:39<br><br>S/T: 683:09:27:13<br><br>OV-102: 221:15:11:06<br><br>DISTANCE: 1,500,000 sm | 104/104/109%<br><br>PREDICTED: 100/104/104/67/104<br><br>ACTUAL: 100/104/104/67/104 1 = 2012 (19) 2 = 2109 (17) 3 = 2019 (17)<br><br>M 3 EOM: WEIGHT: 235510 LBS X CG: 1078.45<br><br>LANDING: WEIGHT: 235421 LBS X CG: 1079.99 | BI-086<br><br>RSRM 59<br><br>ET-84 LWT-77<br><br>ET PRED RPT: 271.3K<br><br>ET BRKUP: 214K<br><br>ET IMPACT 1:21:10 MET LAT: 13.68°N LONG: 163.15°W | 28.46 (44)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 163.5 X 160.1 NM<br><br>DEORBIT: 162.7 X 158.3 NM<br><br>VELOCITY: 25791 FPS<br><br>ENTRY RANGE: 4402 NM | OI-25 (5)<br><br>CARGO: 34373 LBS<br><br>PAYLOAD CHARGEABLE: 25556 LBS<br><br>DEPLOYED: NONE<br><br>NON-DEPLOYED: 23536 LBS<br><br>MIDDECK: 2020 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 833955 LBS NON-DEPLOYED: 1189266 LBS CARGO TOTAL: 2489727 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3100 FUEL BIAS: 884 FINAL TDDP: 4820 RECON: 3741<br><br>PAYLOADS: PLB: Microgravity Science Laboratory. Protein Crystallography, Combustion Science, and Materials Sciences (MSL-1/LM) OARE CRYOFD<br><br>MIDDECK: SAREX-II MSX<br><br>5 CRYO TK SETS + 4 EDO 5 N2 TANKS<br><br>EDO PALLET<br><br>NO RMS | KSC W/D: OPF 73, VAB 6, PAD = 24, 103 days total.<br><br>LAUNCH POSTPONEMENTS: - Baselined 3/27/97 as launch date on 12/14/95. - Postponed launch date to 4/3/97 on 1/16/97<br><br>LAUNCH SCRUBS: - Scrubbed 4/3/97 launch on 4/1/97 at approximately L-42 hours based on decision to add missing insulation blankets to water coolant lines on 576 bulkhead.<br><br>LAUNCH DELAYS: - Launch delayed 20M32S during T-9 minute hold because the cabin pressurization probe nose seal was found damaged and was replaced. Followed by high O <sub>2</sub> reading in mid-body caused by cabin vent into PLB.<br><br>TAL WX: - Banjul (prime and selected) and Moron were forecast and observed GO. Ben Guerir was forecast NO-GO for crosswinds but observed GO.<br><br>DOLILU-II I-LOADS: - DOLILU-II uplink #16, I-Load uplink #33.<br><br>FLIGHT DURATION CHANGES: - Planned NEOM was on orbit 251. A Minimum Duration Flight (MDF) was declared due to concern about fuel cell 2 substack 3 increasing delta volts. Landing occurred on orbit 64 (11 days and 11 orbits early).<br><br>FIRSTS/LASTS: - First U.S. spaceflight with female flight director for ascent (Linda Ham).<br><br>SIGNIFICANT ANOMALIES: - FC2 substack 3 delta volts unusual start up and continuing on orbit trend toward 300 mvolts caused a Minimum Duration Flight (MDF) to be declared. Postflight analysis indicated trend in multiple cells, not a single cell. - FC2 H <sub>2</sub> reactant valve failed to close by switch action when shutting down FC2 (regulator vented reactants). Valve closed 6 hours later. - Y star tracker bypassed by PASS. - Z star tracker pressure fail. - F3F failed off (low PC). - Subsystem RAU E transient - Multiple ECOS "hang" occurrences. |   |   |
|                                      |                             |   |  |   |   |   |  |  |  |   |   |
| S98-16095--<br>In JSC MCC:<br>Linda Ham,<br>first female<br>Ascent Flight<br>Director.<br>(Photo is from<br>STS-095) |                             |    |  |   |   |   |  |  |  |   |   |
|  |                             |    |  |   |   |   |  |  |  |   |   |
|  |                             |   |  |   |   |   |  |  |  |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-102 - STS-84

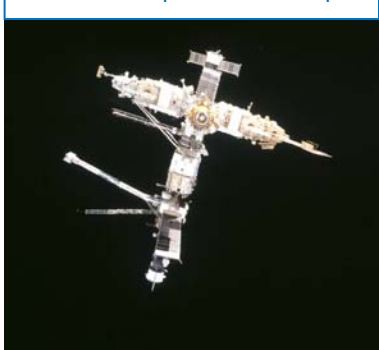
| FLT NO.   | ORBITER  | CREW (8) 7 UP & 7 DOWN<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT   |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|--|--|--|---|---|---|---|--|--|---|
| STS-84<br><br>SEQ<br>FLT #84<br><br>KSC-84<br><br>PAD<br>39A-48<br><br>MLP-2  | OV-104 (Flight 19)<br>Atlantis<br><br>Spacehab 7<br><br>OMS PODS:<br>LPO3-23<br>RPO4-19<br>FRC4-19 | CDR:<br>Charles J. Precourt (Flt 3 - STS-55, STS-71)<br>P482/R161/V118/M141<br>PLT:<br>Eileen M. Collins (Flt 2 - STS-63)<br>P483/R188/V139/F24<br>M/S 1 (PAYLOAD CDR):<br>Jean-Francois Clervoy (Flt 2 - STS-66)<br>ESA Astronaut (France)<br>P484/R186/V140/M163<br>M/S 2:<br>Carlos I. Noriega<br>P485/R221/M193<br>M/S 3:<br>Edward T. Lu<br>P486/R222/M194<br>M/S 4:<br>Elena V. Kondakova (Russia)<br>P487/R223/F29<br>M/S 5:<br>Ascent<br>C. Michael Foale (Flt 4 - STS-45, STS-56 & STS-63, stay on MIR 23, and return on STS-86)<br>P488/R143/V92/M127<br>M/S 6:<br>Descent<br>Jerry M. Linenger (Flt 2 - STS-64, ascent on STS-81, and stay on Mir 22 and 23)<br>P489/R182/V134/M159 | KSC, PAD A<br>135:08:07:47.9Z<br>4:07:48 AM EDT (P)<br>4:07:48 AM EDT (A)<br>Thursday 24<br>5/15/97 (4)<br><br>LAUNCH WINDOW:<br>7M00S<br>MIR PLANAR/<br>PHASE WINDOW<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 33/N/N<br>TAL: ZZA 30<br>AOA: KSC 15/N/N<br>PLS: EDW 22/N/SF<br><br>TDEL: 0.06 0.142/0.18<br><br>MAX Q NAV: 725 728<br><br>SRB STG: 2:04.2 2:04<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN): 2:32 2:37<br><br>NEG RETURN: 4:03 4:05<br><br>PTA (U/S 263): 4:37 4:35<br><br>DROOP (ZZA): 5:20 5:25<br><br>PTM (U/S 263): 6:07 6:07<br><br>MECO CMD: 8:32.1 8:33.4<br><br>VI: 25873 25870<br><br>OMS-2: 44:01.6 43:04<br>75.6 FPS 76 FPS | KSC 33 (KSC 37)<br>144:13:27:43Z<br>9:27:43 AM EDT<br><br>Saturday 18<br>5/24/97 (7)<br><br>DEORBIT BURN:<br>144:12:23:33Z<br><br>X RANGE: 34 NM<br><br>ORBIT DIR: DL 41<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2882 FT<br>144:13:27:43Z<br>VEL: 208 KGS<br>196 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 195: 2989 FT<br><br>DRAG CHUTE<br>DEPLOY: 183 KEAS<br>144:13:27:47Z<br><br>NLGTD: 5720 FT<br>144:13:27:52Z<br>VEL: 175 KGS<br>156 KEAS<br>HDOT: -6.9 FPS<br><br>BRK INIT: 134 KGS<br><br>DRAG CHUTE<br>JETTISON: 53 KGS<br>144:13:28:17Z<br><br>BRK DECEL FPS2: AVE 6.2 PK 9.6<br><br>WHEELS STOP: 144:13:28:36Z<br>11266 FT<br><br>ROLLOUT: 8384 FT<br>53 SEC<br><br>WINDS: 6T, R6 KTS<br>OFFICIAL: 1109P13<br>17, R6<br><br>DENS ALT: 1316 FT<br><br>FLT DURATION: 9:05:19:55<br><br>S/T: 692:14:47:10<br><br>OV-104: 140:03:09:34<br><br>DISTANCE: 3,600,000 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104/<br>67/104<br><br>ACTUAL:<br>100/104/104/<br>67/104<br><br>1 = 2032 (6)<br>2 = 2031 (15)<br>3 = 2029 (15)<br><br>M.3 EOM:<br>WEIGHT: 216168 LBS<br>X CG: 1080.95<br><br>LANDING:<br>WEIGHT: 216021 LBS<br>X CG: 1082.57 | BI-087<br><br>RSRM<br>60<br><br>ET-85<br><br>LWT-78<br><br>ET<br>PRED<br>RPT: 271.3K<br><br>ET<br>BRKUP: 214K<br><br>ET<br>IMPACT<br>1:26:42<br>MET<br>LAT: 0.95°S<br>LONG: 128.0°W | 51.65<br>(7)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>160.6 X 85.5<br>NM<br><br>TI<br>1:17:11:52<br>MET<br>215.6 X 203.4<br>NM<br><br>7:03:48<br>214.3 X 199.7<br>NM<br><br>07:08:10:39<br>214.3 X 199.7<br>NM<br><br>DEORBIT:<br>214.1 X 199.7<br>NM<br><br>VELOCITY:<br>25906 FPS<br><br>ENTRY<br>RANGE:<br>4397 NM | OI-25<br>(6)<br><br>CARGO:<br>28497 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>19643 LBS<br><br>DEPLOYED:<br>3902 LBS<br><br>NON-DEPLOYED:<br>14605 LBS<br><br>MIDDECK:<br>1136 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1205007 LBS<br>NON-DEPLOYED:<br>2042864 LBS<br>CARGO TOTAL:<br>2518224 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3100<br>FUEL BIAS: 884<br>FINAL TDDP: 938<br>RECON: 868<br><br>PAYLOADS:<br>PLB:<br>SHUTTLE/MIR<br>MISSION 6<br><br>SPACEHAB<br>DOUBLE MODULE<br><br>MIDDECK:<br>CREAM<br>MSX<br>SIMPLEX<br>RME-III<br>EPICS<br>PCG-STES<br>LME<br><br>5 CRYO TK SETS<br>4 N2 TANKS<br><br>NO RMS | KSC W/D: OPF 76, VAB 4, PAD 21 = 101 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline 5/1/97 launch date on 1/12/96.<br>- Postponed launch date to 5/15/97 on 2/1/96 due to STS-78 SRB sooting and heat effects in field joints.<br><br>LAUNCH SCRUBS:<br>- None<br><br>LAUNCH DELAYS:<br>- None<br><br>TAL WX:<br>- Zaragoza (prime and selected), Moron, and Ben Guerir All forecast GO and observed GO.<br><br>DOLILU-II I-LOADS:<br>- DOLILU-II uplink #15, I-Load uplink #34<br><br>SHUTTLE NIGHT LAUNCH #17<br><br>FLIGHT DURATION CHANGES:<br>- Waved off landing on orbit 144 due to forecast of 5000 feet variable broken and too dynamic.<br>- Extended flight one orbit and landed on orbit 145.<br><br>EVENTS:<br>- Elena Kondakova's first flight was on Soyuz TM-17.<br>- Mir 23 crew is Commander Vasily Tsibilyev and Flight Engineer Alexander Lazutkin.<br>- Mir capture at MET 1:18:25:36. Hooks closed at MET 1:18:33.<br>- Hatch open at MET 1:20:16.<br>- Crew transfer time: Foale to Mir 23 and Linenger to STS-84 was 2D6H13M. Linenger stay time on Mir was 122:04:36:25 and total flight time was 132:04:00:20.<br>- Transferred equipment, 1038 lbm H <sub>2</sub> O, 82 lbm O <sub>2</sub> , and 21 lbm N <sub>2</sub> to Mir.<br>- Hatch closing at MET 6:04:32; undocking at MET 6:15:56.<br><br>FIRSTS:<br>- First EVA by a U.S. astronaut from Mir Space Station to deploy optical properties monitor by Linenger and Tsibilyev. EVA was on 4/29/97. Exit from KVANT-2 airlock in Orlan M suit. Duration 4:57:30.<br><br>RENDEZVOUS #37:<br>- Rendezvous and dock with Mir (sixth docking).<br><br>SIGNIFICANT ANOMALIES:<br>- GPC Transient Mode Switch - dump indicated it was procedural problem.<br>- Aft PL MNC amps measurement failed.<br>- GPS/INS and GPS DTO problems.<br>- Primary VHF and radio interface unit failure.<br>- Window 1 impact reported by crew.<br>- MS4 lightweight seat entry position/"A" hatch interference. |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
| MCC WHITE FCR (14)  |  |  |  |  |   |   |   |   |  |  |   |
| FLIGHT DIRECTORS:<br>A/E - N. W. Hale<br>LD/O 1 - P. L. Engelauf<br>O 2 - R. E. Castle<br>PLNG - P. F. Dye<br>MOD - A. L. Briscoe |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |
|   |  |  |  |  |   |   |   |   |  |  |   |



MCC WHITE FCR (14)

FLIGHT DIRECTORS:  
A/E - N. W. Hale  
LD/O 1 - P. L. Engelauf  
O 2 - R. E. Castle  
PLNG - P. F. Dye  
MOD - A. L. Briscoe

Russia's Mir-post Atlantis sep.



STS084-366-015 --- Crews from STS-84 & Mir-23 onboard Spacehab Double Module tie record (ten) for number of persons in orbiting spacecraft. Front from left: Linenger, Vasil V. Tsibilyev, Precourt, Aleksandr L. Lazutkin & Foale. Back, from left: Lu, Collins, Clervoy, Kondakova & Noriega.

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-103 - STS-94

| FLT NO.   | ORBITER  | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE,<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET  | ORBIT<br>INC<br>HA/HP  | FSW  | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|--|--|---|---|---|---|--|--|---|---|
| <b>STS-94</b><br>(STS-83R)<br><br>SEQ<br>FLT #85<br><br>KSC - 85<br><br>PAD 39A-49<br><br>MLP-1 | OV-102<br>(Flight 23)<br>Columbia<br><br>21st Spacelab<br>Flight<br><br>LM-15<br><br>EDO 11<br><br><u>OMS PODS:</u><br>LPO5-12<br>RPO5-11<br>FRC2-23 | <u>CDR:</u><br>James D. Halsell, Jr.<br>(Flt 4 - STS-65, STS-74, &<br>STS-83)<br>P490/R178/V123/M156<br><br><u>PLT:</u><br>Susan L. Still<br>(Flt 2 - STS-83)<br>P491/R218/V141/F28<br><br><u>M/S 1 (PAYLOAD CDR):</u><br>Janice E. Voss<br>(Flt 4 - STS-57, STS-63, &<br>STS-83)<br>P482/R167/V115/F22<br><br><u>M/S 2:</u><br>Michael L. Gernhardt<br>(Flt 3 - STS-69 & STS-83)<br>P493/R199/V138/M173<br><br><u>M/S 3:</u><br>Donald A. Thomas<br>(Flt 4 STS-65, STS-70,<br>STS-83)<br>P494/R180/V119/M158<br><br><u>P/S 1:</u><br>Roger Crouch<br>(Flt 2 - STS-83)<br>P495/R219/V142/M191<br><br><u>P/S 2:</u><br>Gregory T. Linteris<br>(Flt 2 - STS-83)<br>P496/R220/V143/M192<br><br><u>MCC WHITE FCR (15)</u><br><u>FLIGHT DIRECTORS:</u><br>A/E - L. J. Ham<br>LD/O 3 - R. M. Kelso<br>O 1 - W. D. Reeves<br>O 2 - G. A. Pennington<br>O 3 - J. P. Shannon<br>MOD - A. L. Briscoe | KSC PAD 39A<br>182:18:01:59.96Z<br>(Flt 4 - STS-65, STS-74, &<br>STS-83)<br>2:02:00 PM EDT (A)<br>Tuesday 12<br>7/1/97 (5)<br><br><u>LAUNCH WINDOW:</u><br>2H30M CTOB<br><br><u>EOM PLS:</u> KSC<br><u>TAL:</u> BYD<br><u>TAL WX:</u> BEN<br><br><u>SELECTED:</u><br><u>RTLS:</u> KSC 15/N/N<br><u>TAL:</u> BYD 32<br><u>AOA:</u> EDW 22/N/N<br><u>PLS:</u> EDW 22/N/N<br><br><u>TDEL:</u><br>0.01 0.382/0.42<br><br><u>MAX Q NAV:</u><br>701 PSF 703 PSF<br><br><u>SRB STG:</u><br>2:03.5 2:04<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (BYD):</u><br>2:41 2:41<br><br><u>NEG RETURN:</u><br>3:56 3:58<br><br><u>PTA (U/S):</u><br>5:11 5:08<br><br><u>DROOP (BYD):</u><br>5:27 5:30<br><br><u>PTM (U/S):</u><br>7:03 7:05<br><br><u>MECO CMD:</u><br>8:28.6 8:29<br><br><u>VI:</u><br>25877 25871<br><br><u>OMS-2:</u><br>39:53 39:53<br>222 FPS 221.7 FPS<br><br><u>BURN TIME:</u><br>2:23 2:23 | KSC 33 (KSC 38)<br>198:10:46:33Z<br>6:46:33 AM EDT<br><br>Thursday 9<br>7/17/97 (8)<br><br><u>DEORBIT BURN:</u><br>198:09:43:45Z<br><br><u>XRANGE:</u> 81.7 NM<br><br><u>ORBIT DIR:</u> DL 42<br><br><u>AIM PT:</u> NOMINAL<br><br><u>MLGTD:</u> 3056 FT<br>198:10:46:33Z<br>VEL: 208 KGS<br>202 KEAS<br>HDOT: -1.1 FPS<br><br><u>TD NORM 205:</u><br>2774 FT<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u> 194 KEAS<br>198:10:46:37Z<br><br><u>NLGTD:</u> 6583 FT<br>198:10:46:44Z<br>VEL: 158 KGS<br>152 KEAS<br>HDOT: -5.9 FPS<br><br><u>BRK INIT:</u> 100 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u> 52 KGS<br>198:10:47:12Z<br><br><u>BRK DECEL FPS2:</u><br>AVE 5.8 PK 7.2<br><br><u>WHEELS STOP:</u><br>198:10:47:31Z<br>11948 FT<br><br><u>ROLLOUT:</u><br>8892 FT<br>58 SEC<br><br><u>WINDS:</u> T1, 0X KTS<br><u>OFFICIAL:</u> 1502P02<br>T2, 0X KTS<br><br><u>DENS ALT:</u> 1113 FT<br><br><u>FLT DURATION:</u><br>15:16:44:33<br><br><u>S/T:</u> 708:07:31:41<br><br>OV-102:<br>237:07:55:39<br><br><u>DISTANCE:</u><br>6,200,000 sm | 104/104/<br>109%<br><br><u>PREDICTED:</u><br>100/104/104/<br>67/104<br><br><u>ACTUAL:</u><br>100/104/104/<br>69/104<br><br>1 = 2037 (4)<br>2 = 2034 (9)<br>3 = 2033 (9)<br><br><u>M 3 EOM:</u><br><u>WEIGHT:</u><br>230818 LBS<br><u>X CG:</u><br>1078.40<br><br><u>LANDING:</u><br><u>WEIGHT:</u><br>230773 LBS<br><u>X CG:</u><br>1080.10 | BI-088<br><br>RSRM<br>62<br>ET-86<br><br>LWT-79<br><br>ET<br><u>PRED</u><br><u>RPT:</u><br>271.3K<br><br>ET<br><u>BRKUP:</u><br>214K<br><br>ET<br><u>IMPACT</u><br>1:21:04<br>MET<br><u>LAT:</u><br>13.5°N<br><u>LONG</u><br>163.46°<br>W | 28.45<br>(45)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>163.4 X 160.1<br>NM<br><br><br><br><br><u>DEORBIT:</u><br>162 X 156.4 NM<br><br><u>VELOCITY:</u><br>25793 FPS<br><br><u>ENTRY</u><br><u>RANGE:</u><br>4396 NM | OI-25<br>(7)<br><br><br><br><br><br><br><br><br><br><u>DEORBIT:</u><br>162 X 156.4 NM<br><br><u>VELOCITY:</u><br>25793 FPS<br><br><u>ENTRY</u><br><u>RANGE:</u><br>4396 NM | <u>CARGO:</u><br>34359 LBS<br><br><u>PAYLOAD</u><br><u>CHARGEABLE:</u><br>25568 LBS<br><br><u>DEPLOYED:</u><br>0 LBS<br><br><u>NON-DEPLOYED:</u><br>23536 LBS<br><br><u>MIDDECK:</u><br>2032 LBS<br><br><u>SHUTTLE</u><br><u>ACCUMULATED</u><br><u>WEIGHTS:</u><br><u>DEPLOYED:</u><br>837857 LBS<br><u>NON-DEPLOYED:</u><br>1230575 LBS<br><u>CARGO TOTAL:</u><br>2552583 LBS<br><br><u>PERFORMANCE</u><br><u>MARGINS (LBS):</u><br>FPR: 3200<br>FUEL BIAS: 809<br>FINAL TDDP: 2845<br>RECON: 4193<br><br><u>PAYLOADS:</u><br><u>PLB:</u><br>Microgravity Science<br>Laboratory.<br>Protein<br>Crystallography,<br>Combustion<br>Science, and<br>Materials Sciences<br>(MSL-1/LM)<br>OARE<br>CRYOFD<br><br><u>MIDDECK:</u><br>SAREX-II<br>MSX<br><br>5 CRYO TK SETS +<br>4 EDO<br>5 N2 TANKS<br>EDO PALLET<br><br>NO RMS | <u>KSC W/D:</u> OPF 53, VAB 7, PAD 21 = 81 days total.<br><br><u>LAUNCH POSTPONEMENTS:</u> None<br>- Reflight of MSL-01/STS-83 was baselined as STS-83R on 4/10/97 with a launch date of 7/1/97.<br>- On 4/25/97, STS-83R was renumbered STS-94.<br><br><u>LAUNCH SCRUBS:</u> None<br><br><u>LAUNCH DELAYS/EARLY LAUNCH TIMES:</u><br>At the L-1 MMT, the weather forecast at KSC for 7/1/97 launch at 1837Z was thunderstorms/rain with 90% probability of NO-GO. The decision was made to move the launch time 47 minutes early to improve the probability of launch, which changed the EDW landing opportunities from 2-2-2 to 1-1-1. New launch time was 1750Z. Counted down to T-9 minutes and held due to thunderstorm forecast for RTLS landing time. Thunderstorms at RTLS time was removed from the forecast. Launch delay was 12M00S<br><br><u>TAL WX:</u><br>Banjul was prime and selected. Banjul was NO GO for most of the count for 3000 feet broken but became GO late in count. Ben Guerir forecast and observed GO.<br><br><u>DOLILU-II I-LOADS:</u><br>DOLILU-II uplink #16, I-load uplink #35.<br><br><u>KSC LANDING WEATHER:</u><br>- Forecast for landing time was technically NO-GO for rain within 30 NM; however, rain was offshore, moving NE, and approach path was clear. Observed GO at deorbit burn minus 2 minutes. At landing time, rain was 29 ESE. Flight rule waiver written.<br><br><u>FLIGHT DURATION CHANGES:</u> None.<br><br><u>FIRSTS/LASTS:</u><br>- First reflight of same payloads (MSL-01 with same crew after STS-83 minimum duration flight declared due to FC2, substack 3 delta volts change).<br>- First flight of Wraparound DAP (called part 5) used for complete entry. RCS usage 500 lbs vs baseline 700 lbs and redline 1430 lbs (28.45 inclination).<br><br><u>EVENTS:</u><br>- Entry was observed at approx 16 degrees elevation in Houston.<br>- Deorbit burn was 298.5 FPS.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Fuel cell 3, substack 2, cell performance monitor output increased approximately 32 mv in 20 minutes.<br>- TDRSS Ku-band channel lock dropouts (worse with 48 MBPS on TDRS-E).<br>- Loss of aero surface actuator (ASA) 4 redundant power.<br>- Lower port fastener retainer housing separated from locker L6G (transfer from Spacelab to MF28K & M as DTO).<br>- Ku-band channel 2 frequency shifts.<br>- Ku-band roll/alpha gimbal anomaly.<br>- Window #7 debris impact reported by crew.<br>- APU 3 fuel isolation valves on heated string B cycling low.<br>- Tempus top video camera failure. |





STS094-344-001  
Crouch (front) &  
Gernhardt at the  
NASDA Large  
Isothermal  
Furnace (LIF)  
facility.



STS094-307-001 --- Inflight crew portrait.  
Front (lt to rt): PLT Still & Voss/PLC.  
Middle row (lt to rt): Gernhardt/MS, CDR  
Halsell, & Linteris/PS. Back row:  
Thomas/MS (left) & Crouch/PS.



## Page 2-104 - STS-85




| FLT NO.  | ORBITER                         | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET   | ORBIT   |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------------------------------|--|---|--|---|---|---|---|--|--|---|
| STS-85<br>SEQ FLT #86<br>KSC - 86<br>PAD 39A-50<br>MLP-3                           | OV-103 (Flight 23)<br>Discovery | CDR: Curtis L. Brown, Jr. (Flt 4 - STS-47, STS-66 & STS-77)<br>P497/R152/V112/M136<br>PLT: Kent V. Rominger (Flt 3 - STS-73, STS-80)<br>P498/R200/V131/M174<br>M/S 1 (PAYLOAD CDR): N. Jan Davis (Flt 3 - STS-47, STS-60)<br>P499/R153/V100/F17<br>M/S 2: Robert L. Curbeam, Jr. P500/R224/M195<br>M/S 3: Stephen K. Robinson P501/R225/M196<br>P/S 1: Bjarni V. Tryggvason (Canada) P502/R226/M197<br><br>MCC WHITE FCR (16)<br><br>FLIGHT DIRECTORS: A/E/O1 - N. W. Hale<br>LD/O 2 - B. P. Austin<br>PLNG - G. A. Pennington<br>MOD - A. L. Briscoe & J. W. Bantle | KSC PAD 39A<br>219:14:40:59.98Z<br>(Flt 4 - STS-47, STS-66 & STS-77)<br>10:41:00 AM EDT (P)<br>10:41:00 AM EDT (A)<br>Thursday 25<br>8/7/97 (6)<br><br>LAUNCH WINDOW: 1H39M CHRISTA-SPAS BETA REQUIREMENTS<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED: RTLS: KSC 33/N/N<br>TAL: MRN 20/N/N<br>AOA: NOR 35/N/SF<br>PLS: EDW 22/N/N<br><br>TDEL: 0.0 -0.198/-0.16<br><br>MAX Q NAV: 699 PSF 703 PSF<br><br>SRB STG: 2:03.8 2:04<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN): 2:53 2:50<br><br>NEG RETURN: 4:01 4:02<br><br>PTA (U/S 298): 5:11 5:12<br><br>DROOP (ZZA): 5:28 5:34<br><br>PTM (U/S 579): 7:05 7:10<br><br>MECO CMD: 8:30.7 8:32.7<br><br>VI: 25831 25823<br><br>OMS-2: 33:06 33:06<br>254 FPS 254 FPS | KSC 33 (KSC 39)<br>231:11:07:58Z<br>7:07:58 AM EDT<br><br>Tuesday 13<br>8/19/97 (5)<br><br>DEORBIT BURN: 231:10:07:30Z<br><br>X RANGE: 346 NM<br><br>ORBIT DIR: AR 7<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2917 FT<br>231:11:07:58Z<br>VEL: 199 KGS<br>192 KEAS<br>HDOT: -1.5 FPS<br><br>TD NORM 195: 2550 FT<br><br>DRAG CHUTE<br>DEPLOY: 185 KEAS<br>231:11:08:01Z<br><br>NLGTD: 6065 FT<br>231:11:08:09Z<br>VEL: 153 KGS<br>144 KEAS<br>HDOT: -6.1 FPS<br><br>BRK INIT: 84 KGS<br><br>DRAG CHUTE<br>JETTISON: 55 KGS<br>231:11:08:37Z<br><br>BRK DECEL FPS: 2: AVE 5.7 PK 7.2<br><br>WHEELS STOP: 231:11:09:07Z<br>11709 FT<br><br>ROLLOUT: 8792 FT<br><br>WINDS: T5, L3 KTS<br>OFFICIAL: 2006P09, T4, L5 KTS<br><br>DENS ALT: 1565 FT<br><br>FLT DURATION: 11:20:26:58<br><br>S/T: 720:03:58:39<br><br>OV-103: 167:19:53:59<br><br>DISTANCE: 4,725,000 sm | 104/104/<br>109%<br><br>PREDICTED: 100/104/104/<br>67/104<br><br>ACTUAL: 100/104/104/<br>67/104<br><br>1 = 2041 (3)<br>2 = 2039 (3)<br>3 = 2042 (2)<br><br>M 3 EOM: WEIGHT: 221335 LBS<br>X CG: 1081.95<br><br>LANDING: WEIGHT: 221264 LBS<br>X CG: 1083.63 | BI-089<br><br>RSRM 57<br><br>ET-87<br><br>LWT-80<br><br>ET PRED RPT: 271.3K<br><br>ET BRKUP: 214K<br><br>ET IMPACT 1:14:30 MET<br>LAT: 42.77°S<br>LONG 154.86°W | 57 (19)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 161 X 160 NM<br><br>SEP-1: 219:22:28:00<br>160.0 X 158.9 NM<br><br>TI: 228:12:50:47<br>157.7 X 154.3 NM<br><br>DEORBIT: 4492 NM<br><br>VELOCITY: 25755 FPS<br><br>ENTRY RANGE: 4492 NM<br><br>ENTRY ATTITUDE: 139.2 X 138.4 NM | OI-26 (1)<br><br>CARGO: 317959 LBS<br><br>PAYLOAD CHARGEABLE: 24982 LBS<br><br>DEPLOYED: 0 LBS<br><br>NON-DEPLOYED: 24982 LBS<br><br>MIDDECK: 1590 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 837857 LBS<br>NON-DEPLOYED: 1247831 LBS<br>CARGO TOTAL: 2584542 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3200<br>FUEL BIAS: 809<br>FINAL TDDP: 1446<br>RECON: 3065<br><br>PAYLOADS: PLB: CRISTA-SPAS-02 (Atmospheric physics, dynamics, and chemistry by MAHRSL, SESAM, MIDES, GAPs, and IPEX)<br>MFD (Robot Arm)<br>TAS-01 (8 technology and science experiments)<br>IEH-2 (UV exp)<br><br>MIDDECK: SWUIS, BDS-03, BRIC-10, PCG-STES, SSCE, ACIS, MSX, SIMPLEX<br><br>5 CRYO TK SETS<br>5 N2 TANKS<br>RMS 48 (S.N. 301)<br>RMS Used For CHRISTA-SPAS deploy, grapple, and berth | KSC W/D: OPF 102, VAB 5, PAD 23 = 130 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 7/17/97 on 3/28/96.<br>- Postponed launch date to 8/7/97 on 4/17/97 caused by remanifest to reflly MSL-1 due to STS-83 early termination.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH DELAYS: None<br><br>TAL WX:<br>- ZZA was prime but forecast NO GO with thunderstorms within 20 nm. MRN (selected) and BEN were forecast and observed GO.<br><br>DOLILU-II I-LOADS:<br>DOLILU-II uplink #17, I-load uplink #36.<br><br>PERFORMANCE ENHANCEMENTS (FIRST FLIGHT):<br>- Flight control filter updates.<br>- Yaw gain enhancement.<br>- Constant pitch rate at SRB separation.<br><br>FLIGHT DURATION CHANGES:<br>- Planned landing time was 230:11:14 on 8/16/97, orbit 174.<br>- Waved off this only landing opportunity to land at KSC due to forecast of probability of fog. SLF was observed GO at landing time. Landed on orbit 190.<br>- Flight duration extended 1 day.<br><br>FIRSTS/LASTS:<br>- First flight of OI-26.<br>- First flight at 57 degrees inclination since STS-66.<br>- First flight of complete Wraparound DAP (DTO 255). Used approx 330 lbm RCS from EI to M-1 (vs. redline of 1630 lbm).<br><br>FOURTH SHUTTLE CREWMEMBER REPLACEMENT<br>- Jeff Ashby was replaced by Rominger in March 1997. (Third shuttle crewmember replacement occurred on STS-46).<br><br>EVENTS:<br>- Launched on Kent Rominger's birthday.<br>- CHRISTA-SPAS deployed at 00:07:46:04 MET, 219:22:27:04Z.<br>- CHRISTA-SPAS captured at 228:15:13Z, 09:00:32 MET.<br>- Berthed and latched at 228:16:30:12Z, 09:01:49:32 MET.<br><br>RENDEZVOUS #38: Deployed, rendezvoused, grappled, and berthed CHRISTA-SPAS.<br><br>SIGNIFICANT ANOMALIES:<br>- CRT 1 transient BITE message.<br>- Supply H <sub>2</sub> O tank A quantity erratic.<br>- APU 1 seal cavity drain line pressure decay.<br>- APU 1 fuel pump thermostat cyclic in narrow band.<br>- Payload commanding problems with MCC input set to 3/sec. |  |   |
| STS085-706-051--- Release of CRISTA-SPAS-2   |                                 |  |   |  |   |   |   |   |  |  |   |
|  |                                 |  |   |  |   |   |   |   |  |  |   |
|  |                                 |  | STS085-326-016 Impromptu in-flight crew portrait: (Left to right) PLT Rominger, Curbeam/MS, Robinson/MS, CDR Brown, Davis/MS/PLC, & Tryggvason/PS Canada).  |  |   |   |   |   |  |  |   |



## Page 2-105 - STS-86


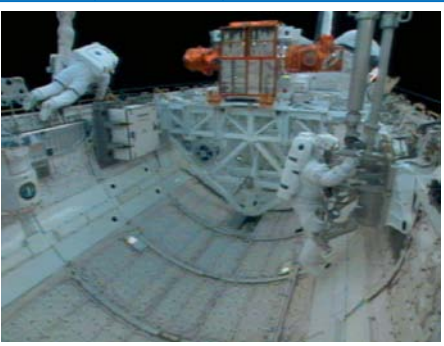

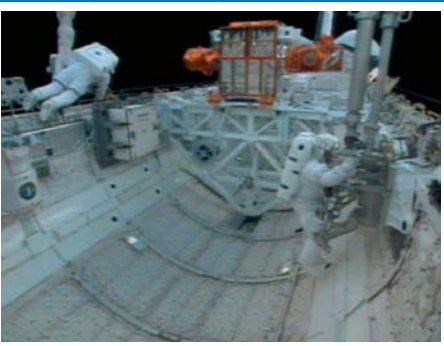

[illegible]

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (8)<br>7UP, 7DOWN<br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|---|---------|---|--|---|---|--------------------------|-----------------------|--|-----|--|--|--|
| STS-86<br>Continued   |         | Continued...<br><br>SS EVA #39<br>EMU/Tethered EVA #32<br>Scheduled EVA #34<br>10/1/97<br>5H01M26S Duration<br><br>MCC WHITE FCR (17)<br><br><u>FLIGHT DIRECTORS:</u><br>A/E - L. J. Ham<br>LD/O 1 - P. D. Dye<br>O 2 - C. W. Shaw<br>PLNG - P. L. Engelauf<br>MOD - R. E. Castle |  | Continued...<br><br><u>DENS ALT:</u><br>1506 FT<br><br><u>FLT DURATION:</u><br>10:19:20:51<br><br><u>S/T:</u><br>730:28:19:30<br><br><u>OV-104:</u><br>150:22:30:25<br><br><u>DISTANCE:</u><br>4,225,000 sm | <br><b>STS086-371-004 -- Seven STS-86 crew members are joined by the three-member Mir-24 crew in the Spacehab Module for in-flight portrait. New Mir-24 crew member Wolf holds a cap (right). Clockwise from him are: Titov/MS/RSA, Mir CDR Anatoliy Y. Solovyev, Parazynski/MS, Pavel V. Vinogradov/Mir/FE, CDR Wetherbee, Lawrence/MS, Foale/MS, PLT Bloomfield, &amp; Chretien/MS.</b> |                          |                       |  |     | Continued . . .<br><br><u>EVENTS:</u><br>- Mir capture at 270:19:57:46Z, 01:17:23:27 MET<br>- Docking complete at 270:20:06:15Z, 01:17:31:56 MET<br>- Foale transfer to STS-86 and David Wolf transfer to Mir 24 at 2D14H00M, 271:16:34:19Z. Foale Mir stay time 134:02:13:31, total flight time 144:13:47:22.<br>- Foale completed a Mir EVA with Anatoly Solovyev with exit from KVANT-2 airlock in Orlan M suits (5.7 psia). Both were double tethered using U.S. tether reel and waist tethers. EVA duration was 5H59M to inspect Specktr module leak, slew solar arrays, and put out dosimeter.<br>- Scott Parazynski and Vladimir Titov made a Shuttle EVA to retrieve MEEP experiments left on Mir DM on STS-76.<br>- Jean-Loup Chretien flew on Soyuz T-6/Salyut 7 and Soyuz TM-7/Mir11.<br>- Hooks open 276:17:25:59Z, 07:14:51:40 MET<br>- Undock 276:17:28:15Z, 07:14:53:56 MET (one rev late to check Mir computer interface box).<br>- Total consumables transferred to Mir: 1717.2 lbm H <sub>2</sub> O (17 CWC's), 75.7 lbm O <sub>2</sub> , 130.7 lbm N <sub>2</sub> .<br>- Wendy was to replace Foale; however, concerns of inadequate reach in Orlan EVA spacesuit, Wolf moved to STS-86 from STS-89.<br><br><u>RENDEZVOUS #39:</u><br>Rendezvous and dock with Mir Space Station.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Fuel Cell 2 substack 1 differential volts transient.<br>- Primary RCS thruster L3D failed off.<br>- EVA Safety Tether Reel failure.<br>- WSB 3 vent heater failure on B controller. |  |  |
| <br><b>STS086-332-021--Parazynski tethered to cargo bay handrail during EVA shared Titov (RSA) out of photo.</b> |         | <br><b>sts086-720-056 -- Mir as seen by departing Atlantis.</b>  |  |   |   |                          |                       |  |     |  |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER   | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG, THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT INC HA/HP  | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|--|---|---|---|---|--|--|--|---|
| STS-87<br>SEQ FLT #88<br>KSC - 88<br>PAD 39B-37<br>MLP-1  | OV-102 (Flight 24)<br>Columbia<br>22nd Spacelab Flight<br>EDO 12<br>OMS PODS: LPO5-13 RPO5-12 FRC2-24 | CDR: Kevin R. Kregel (Flt 3 - STS-70, STS-78) P511/R197/V129/M172<br>PLT: Steven W. Lindsey P512/R229/M200<br>M/S 1: Kalpana Chawla P513/R230/F30<br>M/S 2: Winston E. Scott (Flt 2 - STS-72) P514/R207/V148/M180<br>M/S 3: Takao Doi (Japan) P515/R231/M201<br>P/S 1: Leonid Kadenyuk (Ukraine) P516/R232/M202<br>SS EVA #40 EMU/Tethered EVA #33 Scheduled EVA #35 on 11/24/97 7H42M55S Duration EVA start at 05:04:16:05 MET<br>SS EVA #41 EMU/Tethered EVA #34 Unscheduled EVA #6 on 12/3/97 4H59M40S Duration EVA start at 13:13:24 MET | KSC PAD 39B 323:19:45:95.6Z 2:46:00 PM EST (P) 2:46:00 PM EST (A) Wednesday 9 11/19/97 (12)<br>LAUNCH WINDOW: 2H30M CTOB<br>EOM PLS: KSC TAL: BYD TAL WX: BEN, MRN<br>SELECTED: RTLS: KSC 33/C/N TAL: BYD 32/N/N AOA: EDW 22/N/N PLS: NOR 17/N/SF<br>TDEL: -0.03 0.132/0.17<br>MAX Q NAV: 731 741<br>SRB STG: 2:03.8 2:04<br>PERF: NOMINAL<br>2 ENG TAL (BYD): 2:38 2:41<br>NEG RETURN: 3:58 3:59<br>PTA (U/S 219): 4:59 4:58<br>DROOP (BYD): 5:25 5:30<br>PTM (U/S 567): 6:58 7:00<br>MECO CMD: 8:28.5 8:29.9<br>VI: 25872 25873<br>OMS-2: 41:04 41:08.9 192.9 FPS 193.8 FPS 2:05 2:08 | KSC 33 (KSC 41) 339:12:20:04Z 7:20:04 AM EST<br>Friday 10 12/5/97 (9)<br>DEORBIT BURN: 339:11:21:28Z<br>XRANGE: 66 NM<br>ORBIT DIR: DL 43<br>AIM PT: CLOSE IN<br>MLGTD: 2549 FT 339:12:20:04Z<br>VEL: 189 KGS 196 KEAS<br>HDOT: -1.1 FPS<br>TD NORM 205: 1821 FT<br>DRAG CHUTE DEPLOY: 188 KEAS 339:12:20:08Z<br>NLGTD: 5612 FT 339:12:20:14Z<br>VEL: 147 KGS 151 KEAS<br>HDOT: -4.6 FPS<br>BRK INIT: 107 KGS<br>DRAG CHUTE JETTISON: 61 KGS 339:12:20:38Z<br>BRK DECEL FPS2: AVG 4.7 PK 7.7<br>WHEELS STOP: 339:12:21:02Z 10553 FT<br>ROLLOUT: 8004 FT 58 SEC<br>WINDS: 6H, 0X KTS OFFICIAL: 3306P10 6H, 0X KTS<br>DENS ALT: -195 FT<br>FLT DURATION: 15:16:34:04<br>S/I: 746:15:53:34<br>OV-102: 253:00:29:43<br>DISTANCE: 6,544,000 sm | 104/104/ 109%<br>PREDICTED: 100/104/104/ 67/104<br>ACTUAL: 100/104/104/ 67/104<br>1 = 2031 (16)<br>2 = 2039 (4)<br>3 = 2037 (5)<br>M 3 EOM: WEIGHT: 232930 LBS X CG: 1080.99<br>LANDING: WEIGHT: 232849 LBS X CG: 1082.58 | BI-092<br>RSRM 63<br>ET-89<br>LWT-82<br>ET PRED RPT: 277.3K<br>ET BRKUP: 269.1K<br>ET IMPACT 1:25:02 MET<br>LAT: 20.28°N LONG: 147.99°W | 28.45 (46)<br>DIRECT INSERTION<br>POST OMS-2: 155 X 150 NM<br>SEP BURN: 02:03:25:30 MET<br>NC5<br>MANEUVER: 05:01:33:33 MET<br>TI: 05:03:04:38 MET<br>DEORBIT: 149.7 X 145.5 NM<br>VELOCITY: 25760 FPS<br>ENTRY RANGE: 4424 NM | OI-26 (3)<br>CARGO: 34395 LBS<br>PAYLOAD CHARGEABLE: 21946 LBS<br>DEPLOYED: 0 LBS<br>NON-DEPLOYED: 17496 LBS<br>MIDDECK: 1452 LBS<br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 843915 LBS NON-DEPLOYED: 1281760 LBS CARGO TOTAL: 2648665 LBS<br>PERFORMANCE MARGINS (LBS): FPR: 3085<br>FUEL BIAS: 853 FINAL TDDP: 4384 RECON: 6115<br>PAYLOADS: PLB: SPARTAN-201 USMP-04 EDFT-05 SOLSE GAS (1) NASBE LHP TGDF AERCAM SPRINT<br>MIDDECK: USMP-04/MGBX CUE, MSX, SIMPLEX<br>5 CRYO TK SETS + 4 EDO<br>5 N2 TANKS RMS 49 (S.N. 301)<br>RMS used for Spartan deploy, capture attempt, and assist berthing. Also EVA EDFT-5 ORU activities. | KSC W/D: OPF 94, VAB 5, PAD 22 = 121 days total.<br>LAUNCH POSTPONEMENTS:<br>- Baseline 10/9/97 launch date on 7/11/97.<br>- Postponed launch date to 11/13/97 on 4/17/97.<br>- Postponed launch date to 11/19/97 on 5/22/97.<br>LAUNCH SCRUBS: None.<br>LAUNCH DELAYS: None.<br>TAL WX:<br>- Banjul (prime and selected), Ben Guerir, and Moron were all forecast and observed GO.<br>DOLILU/I-LOADS:<br>- DOLILU-II uplink #19, total I-load uplink #38.<br>PERFORMANCE ENHANCEMENTS:<br>- Flight control filter updates.<br>- Yaw gain enhancement.<br>- Constant pitch rate at SRB separation.<br>- First stage trim, second stage trim, and roll to headsup.<br>FLIGHT DURATION CHANGES:<br>- None. Landed on orbit 252.<br>FIRSTS/LASTS:<br>- First flight with the following performance enhancements:<br>- Roll-to-heads-up at approximately 6:10 MET, APM loss of 70 lbs.<br>- Ascent DAP trim (APM gain of approximately 270 lbs).<br>- Extended pitch parallel to MECO (APM gain of approximately 125 lbs).<br>- Second stage pitch gimbal relief (no APM change).<br>EVENTS:<br>- Spartan deploy was delayed 1 day to allow recovery of SOHO satellite.<br>- Spartan deploy at 325:21:04:00Z, 02:01:18 MET. Spartan failed to perform pirouette maneuver indicating a problem. Attempt to grapple Spartan at 02:01:24 MET failed, and a tip-off rate of 2 deg/sec was introduced.<br>- Separation burn was made at, 02:03:25:30 MET.<br>- Decision to hand capture Spartan by two EVA crew, done at 05:05:18:00 MET (rates were very low). RMS berth assist was required with Spartan grapple at 05:06:53 and berth at 05:07:37:22 MET.<br>- EDFT-05 tasks were performed on EVA 1 and evaluated crane.<br>- An unscheduled EVA 2 was performed to deploy, maneuver, and retrieve a free flying video camera (AERCAM Sprint) and to perform EDFT-05 tasks which were planned for EVA 1.<br>RADIATOR DEPLOY #20<br>- Starboard and port radiators deployed twice for thermal control and water production.<br>RENDEZVOUS #40: Deploy Spartan, separate, rendezvous and retrieve Spartan.<br>SIGNIFICANT ANOMALIES:<br>- Sticky supply water A/B check valve.<br>- H2 tank 4 quantity measurement failure.<br>- EV 2 helmet light intermittent.<br>- Left outboard tire pressure measurement lost.<br>- Spartan MPESS EVA ingress aid extend/stow difficulty during retrieval.<br>- RCS jet R5D heater fail off.<br>- Excessive tile damage by ET foam loss. |   |
|                           |   |  |   |   |   |    |  |  | STS087-307-002 On middeck: In front (lt to rt), PLT Lindsey, Doi/MS (NASDA) & Scott/MS, In back (lt to rt), CDR Kregel, Chawla/MS, Kadenyuk/PS.  |   |
|                         |   |  |   |   |   |   |  |  | STS087-706-020 ---<br>Spartan 201 satellite in grasp of RMS  |   |
| STS087-E-5048--Scott (left) & Doi grab free-flying Spartan 201 satellite and berth it in shuttle P/L bay. |   |  |   |   |   |   |  |  |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-108 - STS-89

| FLT NO.   | ORBITER  | CREW<br>7 UP, 7 DOWN   | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET  | ORBIT        |  | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|--|--|--|--|---|---|--------------|--|--------------|--|---|
| STS-89<br>SEQ<br>FLT #89<br>KSC - 89<br>PAD 39A-52<br>MLP-3 | OV-105<br>(Flight 12)<br>Endeavour<br><br>Spacehab 9<br><br>OMS PODS:<br>LPO4-19<br>RPO1-26<br>FRC5-12 | CDR:<br>Terrence W. Wilcutt<br>(Flt 3 - STS-68, STS-79)<br>P517/R183/V130/M160<br><br>PLT:<br>Joseph F. Edwards Jr.<br>P518/R233/M203<br><br>M/S 1:<br>James F. Reilly, II<br>P519/R234/M204<br><br>M/S 2:<br>Michael Anderson<br>P520/R235/M205<br><br>M/S 3: (PAYLOAD CDR):<br>Bonnie J. Dunbar<br>(Flt 5 - STS-61-A, STS-32,<br>STS-50, STS-71)<br>P521/R79/V49/F7<br><br>M/S 4:<br>Sailizhan Shakhirich Sharipov<br>(Russia)<br>P522/R236/M206<br><br>M/S 5:<br>Ascent<br>Andrew S. W. Thomas<br>(Flt 2 - STS-77)<br>Stay on Mir 24 and Mir 25,<br>return on STS-91.<br>P523/R213/V149/M186<br><br>M/S 6:<br>Descent<br>David A. Wolf<br>(Flt 2 - STS-58)<br>Ascent on STS-86,<br>stay on Mir 24.<br>P524/R173/V147/M151 | KSC PAD 39A<br>23:02:48:14.98Z<br>9:48:15 PM EST (P)<br>9:48:15 PM EST (A)<br>Thursday 27<br>1/22/98 EST (9)<br><br>LAUNCH WINDOW:<br>7M 56S Using PLT<br>MIR PLANAR/<br>PHASE WINDOW<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 15/C/I/N<br>TAL: ZZA 30/C/I/N<br>AOA: NOR 17/N/SF<br>PLS: EDW 22/N/SF<br><br>TDEL:<br>0.14 -0.098/0.1<br><br>MAX Q NAV:<br>702 PSF 710 PSF<br><br>SRB STG:<br>2:03.8 2:06<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA):<br>2:26 2:25<br><br>NEG RETURN:<br>4:02 4:05<br><br>PTA (U/S 265):<br>4:42 4:35<br><br>DROOP (ZZA):<br>5:20 5:22<br><br>PTM (U/S 265):<br>5:50 5:48<br><br>MECO CMD:<br>8:28.9 8:29<br><br>VI:<br>25876 25873<br><br>OMS-2:<br>41:46 41:48<br>213 FPS 213 FPS | KSC 15 (KSC 42)<br>31:22:35:09Z<br>5:35:09 PM EST<br><br>Saturday 19<br>1/31/98 (8)<br><br>DEORBIT BURN:<br>31:21:27:55Z<br><br>X RANGE: 600NM<br><br>ORBIT DIR: AL 20<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2702 FT<br>31:22:35:09Z<br>VEL: 202 KGS<br>198 KEAS<br>HDOT: -2.3 FPS<br><br>TD NORM 195:<br>2776 FT<br><br>DRAG CHUTE<br>DEPLOY: 190 KEAS<br>31:22:35:13Z<br><br>NLGTD: 6112 FT<br>31:22:35:20Z<br>VEL: 152 KGS<br>149 KEAS<br>HDOT: -5.9 FPS<br><br>BRK INIT: 94 KGS<br><br>DRAG CHUTE<br>JETTISON: 56 KGS<br>31:22:35:53Z<br><br>BRK DECEL FPS2:<br>AVE 3.6 PK 5.0<br><br>WHEELS STOP:<br>31:22:36:21Z<br>12492 FT<br><br>ROLLOUT:<br>9790 FT<br>72 SEC<br><br>WINDS:<br>4T, 4L KTS<br>OFFICIAL: 0205P11<br>7T, 8L<br><br>DENS ALT: -103 FT<br><br>FLT DURATION:<br>8:19:46:54<br><br>S/T: 755:11:40:28<br><br>OV-105:<br>121:08:50:00<br><br>DISTANCE:<br>3,610,000 sm | 104/104/<br>109%<br><br>PREDICTED:<br>100/104/104<br>67/104<br><br>ACTUAL:<br>100/104/104<br>67/104<br><br>1 = 2043 (1)<br>2 = 2044 (1)<br>3 = 2045 (1)<br><br>M 3 EOM:<br>WEIGHT: 217475 LBS<br>X CG: 1086.45<br><br>LANDING:<br>WEIGHT: 217422 LBS<br>X CG: 1088.16 | BI-093<br><br>RSRM<br>64<br><br>ET-90<br><br>LWT-83<br><br>ET<br>RPT:<br>271.3K<br><br>ET<br>BRKUP:<br>269.1K<br><br>ET<br>IMPACT<br>1:27:09<br>MET<br>LAT:<br>0.69°N<br>LONG:<br>120.7°W | 51.65<br>(9) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>162.4 X 161.1<br>NM<br><br>TI:<br>T:15:03:04<br>MET<br>215.6 X 203.4<br>NM<br><br>SEP1:<br>6:15:28:26<br>MET<br>206.6 X 203.2<br>NM<br><br>DEORBIT:<br>207.1 X 193.7<br>NM<br><br>VELOCITY:<br>25900 FPS<br><br>ENTRY<br>RANGE:<br>4341 NM | OI-26<br>(4) | CARGO:<br>28040 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>22163 LBS<br><br>DEPLOYED:<br>4596 LBS<br><br>NON-DEPLOYED:<br>16699 LBS<br><br>MIDDECK:<br>868 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>848511 LBS<br>NON-DEPLOYED:<br>1299327 LBS<br>CARGO TOTAL:<br>2676765 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3272<br>FUEL BIAS: 854<br>FINAL TDDP: 2309<br>RECON: 3594<br><br>PAYLOADS:<br>PLB:<br>SHUTTLE/MIR<br>MISSION 8<br><br>SPACEHAB<br>(Double Module)<br><br>GAS (4)<br>ODS<br><br>MIDDECK:<br>HP, MPNE, AST,<br>CREAM, SIMPLEX,<br>SAMS, MGM (2),<br>CEBAS,<br>EARTH CAM<br><br>5 CRYO TK SETS<br>6 GN2 TANKS<br><br>NO RMS | KSC W/D: OPF 202, VAB 7, PAD 26 = 235 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline 1/15/98 launch date on 10/1/96.<br>- Moved STS-89 from OV-103 to OV-105 on 5/22/97.<br>- Postponed launch date to 1/22/98 EST (1/23/98 GMT) on 12/18/97.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH DELAYS: None<br><br>TAL WX:<br>- Zaragoza (prime and selected) and Moron forecast and observed GO. Ben Guerin was forecast NO GO for ceiling and visibility (very dense fog).<br><br>SHUTTLE NIGHT LAUNCH: #19<br><br>DOLILU/I-LOADS:<br>- DOLILU II uplink #20, total uplink #39.<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard set plus Block IIA SSME's.<br><br>FLIGHT DURATION CHANGES:<br>- None. Landed on orbit 139.<br><br>FIRSTS/LASTS:<br>- First flight using Block IIA SSME's. (Rocketdyne HPFTP)<br>- First flight with external airlock.<br>- Record number of people in orbit: Mir 3 - 2 Russians, 1 American; Soyuz 3 - 2 Russians, 1 French; Endeavour 7 - 6 Americans, 1 Russian.<br><br>EVENTS:<br>- Mir capture at 24:20:14:21Z, 1:17:26:06 MET.<br>- Docking complete at 24:20:23Z, 1:17:35 MET.<br>- Andrew Thomas transferred to Mir 24 and David Wolf to STS-89 Endeavour at 26:05:51:15Z, 3D13H3M. David Wolf total Mir time 119:23:16:56 and total flight time 127:20:00:50.<br>- Undocking at 29:16:56:56Z, 6:14:08:41 MET.<br>- Inert weight adjustment of -200 lbs included in STS OPR chargeable.<br><br>RENDEZVOUS #41:<br>- Rendezvous and dock with Mir.<br><br>RADIATOR DEPLOY #21:<br><br>SIGNIFICANT ANOMALIES:<br>- GPC 3 mode switch no apparent detent at standby. Went to halt from run.<br>- Payload bay floodlights FWB STBD and MID PORT failed (new design).<br>- TIPS and OCA problems.<br>- Z Star Tracker pressure fail BITE.<br>- S-Band antenna electronics 2 failed to select the best antenna.<br>- Vestibule vent valves were misconfigured (3 of 4 open).<br>- Vernier thruster LSD oxidizer temp failed erratic, attitude control passed to Mir jets, then to orbiter PRCS.<br>- Right RCS fuel helium isolation valve B failed to open.<br>- Vernier driver F5 RPC 2 failed off. |



MCC WHITE FCR (19)  
FLIGHT DIRECTORS:  
ASCENT- L.J. Ham  
LD/O1- P.L. Engelhauf  
O2- R.E. Castle  
PLNG- P.S.Hill  
ENTRY- J.P. Shannon  
MOD- A. L. Briscoe



sts089-742-024-- Atlantis with SPACEHAB on approach to Mir.



STS089-391-004 Onboard Mir Base Block: In conventional position (from left) are Wolf/MS(former Mir guest), Pavel V. Vinogradov/ Mir-24/FE, CDR Wilcutt, Mir-24 CDR Anatoly Y. Solovoyev, & Dunbar/MS/PLC. Above, head-to-head with bottom row (from left) Sharipov/MS (RSA), Reilly/MS & PLT Edwards. At 90 deg angle are: Thomas/MS/MirGuest (top) & Anderson/MS.

## Page 2-109 - STS-90

[illegible]





## Page 2-110 - STS-91

[illegible]







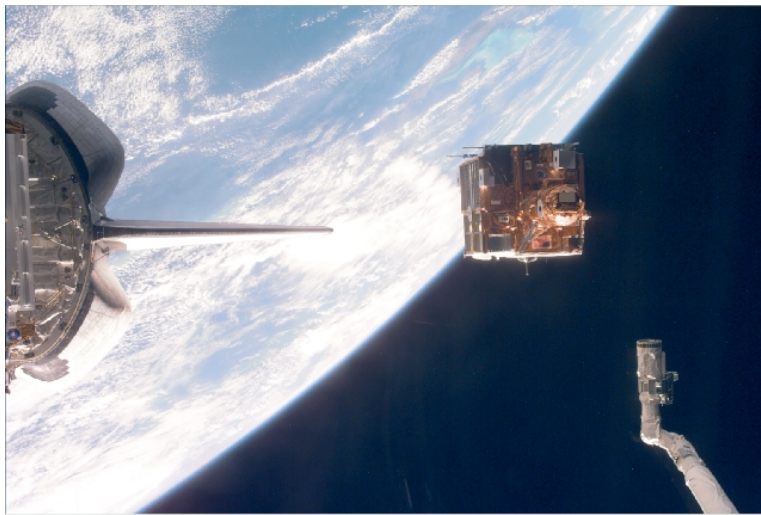
## Page 2-111 - STS-95

| FLT   | ORBITER  | CREW<br>(7)  | LAUNCH SITE,<br>LIFTOFF TIME,   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-<br>ABORT<br>EMERG   | SRB<br>RSRM  | ORBIT          |  | FSW   | PAYLOAD<br>WEIGHTS,   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,                         |
|---|--|--|---|---|---|--|----------------|--|---|---|--|
| NO.   |  | TITLE, NAMES<br>& EVA'S  | LANDING SITES,<br>ABORT TIMES   | LANDING TIMES<br>FLT DURATION,<br>WINDS   | THROTTLE<br>PROFILE<br>ENG. S.N.  | AND<br>ET  | INC            | HA/HP  |   | PAYLOADS/<br>EXPERIMENTS  | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
| STS-95<br><br>SEQ FLT #92<br><br>KSC-92<br><br>PAD<br>39B-39<br>MLP-2 | OV-103<br>(Flight 25)<br>Discovery<br><br>OMS PODS:<br>LPO1 - 28<br>RPO3 - 26<br>FRC3 - 25 | CDR:<br>Curtis L. Brown<br>(Flt 5 - STS-47, STS-66,<br>STS-77, STS-85)<br>P539/R152/V112/M136<br><br>PLT:<br>Steven W. Lindsey<br>(Flt 2 - STS-87)<br>P540/R229/V131/M200<br><br>M/S 1:<br>Stephen K. Robinson<br>(Flt 2 - STS-85)<br>P541/R222/V152/M196<br><br>M/S 2:<br>Scott E. Parazynski<br>(Flt 3 - STS-66, STS-86)<br>P542/R187/V145/M164<br><br>M/S 3:<br>Pedro Duque<br>(ESA-Spain)<br>P543/R245/M213<br><br>P/S 1:<br>Chiaki Mukai<br>(Japan)<br>(Flt 2 - STS-65)<br>P544/R181/V153/F23<br><br>P/S 2:<br>Senator John H. Glenn (2)<br>P545/R246/M214<br><br>MCC WHITE FCR (22)<br><br>FLIGHT DIRECTORS:<br>A/E - L. J. Ham<br>LD/O1 - P. L. Engelauf<br>O 2 - P. S. Hill<br>O 3 - P. F. Dye<br>MOD - J. W. Bantle | KSC 39B<br>302:19:19:33:98Z<br>2:00:00 PM EST (P)<br>2:19:34 PM EST (A)<br>Thursday 28<br>10/29/98 (10)<br><br>LAUNCH WINDOW:<br>2H30M CTOB<br><br>EOM PLS: KSC<br>TAL: BYD<br>TAL WX: BEN, MRN<br><br>SELECTED:<br>RTLS: EDW 15/N/SF<br>TAL: BYD 32/N/SF<br>AOA: EDW 22<br>PLS: EDW 22/C/I/N<br><br>TDEL:<br>-0.03 -0.108/0.07<br><br>MAX Q NAV:<br>755 765<br><br>SRB STG:<br>2:03.7 2:03<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BYD):<br>2:11 2:13<br><br>NEG RETURN:<br>3:45 3:52<br><br>PTA (U/S 500):<br>4:12 4:08<br><br>DROOP:<br>5:21<br><br>PTM (U/S 500):<br>5:13 5:06<br><br>MECO CMD:<br>8:20.7 8:21.6<br><br>VI:<br>26102 26092<br><br>OMS-2:<br>41:57 41:57<br>5.02 FPS 5.02 FPS | KSC 33 (KSC 45)<br>311:17:03:30Z<br>12:03:30 PM EST<br><br>Saturday 20<br>11/7/98 (11)<br><br>DEORBIT BURN:<br>311:15:52:54Z<br><br>XRANGE: 172 NM<br><br>ORBIT DIR: DL 44<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3243 FT<br>311:17:03:30Z<br>VEL: 199 KGS<br>196 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 205:<br>2559 FT<br><br>DRAG CHUTE<br>DEPLOY:<br>NOT USED<br><br>NLGTD: 6248 FT<br>311:17:03:40Z<br>VEL: 164 KGS<br>164 KEAS<br>HDOT: -6.6 FPS<br><br>BRK INIT: 138 KGS<br>8726 FT<br><br>DRAG CHUTE<br>JETTISON:<br>NOT USED<br><br>BRK DECEL FPS2:<br>AVE 5.8 PK 7.8<br><br>WHEELS STOP:<br>311:17:04:30Z<br>12751 FT<br><br>ROLLOUT:<br>9508 FT<br>60 SECS<br><br>WINDS:<br>0H, 10R KTS<br>OFFICIAL:<br>0609P14<br>T0, R9 KTS | 104.5/104.5/<br>109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/67/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>1 = 2048 (1)<br>2 = 2043 (2)<br>3 = 2045 (2)<br><br>ALL BLOCK<br>II A ENGINES<br><br>M 3 EOM<br>WEIGHT:<br>228455 LBS<br>X CG:<br>1076.83<br><br>LANDING:<br>WEIGHT:<br>228388 LBS<br>X CG:<br>1078.45 | BI-096<br><br>RSRM<br>68<br><br>ET-98<br><br>SLWT-2<br><br>SLWT<br>RPT<br>MAX:<br>283K<br>MIN:<br>215K<br><br>SLWT<br>IMPACT<br>1:28:02<br>MET<br>LAT:<br>20.8°N<br>LONG:<br>147.2°W | 28.45°<br>(47) | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>303 X 295 NM<br><br>SEP 1:<br>2:23:46:30<br>MET<br>302.2 X 294<br>NM<br><br>SEP 2:<br>3:06:16:40<br>MET<br><br>TI:5:22:01:37<br>MET<br>301.5 X 293.5<br>NM<br><br>DEORBIT<br>ALT:<br>301.5 X 285.9<br>NM<br><br>VELOCITY<br>26063 FPS<br><br>ENTRY<br>RANGE<br>4290 NM | OI-26B<br>(3)<br><br>CARGO:<br>38618 LBS<br><br>PAYLOAD<br>CHARGABLE:<br>28520 LBS<br><br>DEPLOYED:<br>125 LBS<br><br>NON-DEPLOYED:<br>24108 LBS<br><br>MIDDECK:<br>1314 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>850155 LBS<br>NON-DEPLOYED:<br>1378355 LBS<br>CARGO TOTAL:<br>2824652 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3783<br>FUEL BIAS: 720<br>FINAL TDDP: 1587<br>RECON: 2740<br><br>PAYLOADS:<br>PLB:<br>SPACEHAB<br>(Single)<br>HOST<br>SPARTAN-201<br>(Deploy & Retrieve)<br>(Solar Wind Exp.)<br>GAS (2)<br>IEH-3 (PANSAT)<br>(Deployed)<br><br>MIDDECK:<br>PCG-STES<br>SAREX-II<br>BRIC<br><br>5 CYRO TK SETS<br>5 GN2 TANKS<br><br>Continued... | KSC W/D: OPF 76, VAB 5, PAD 29 = 110 days<br><br>LAUNCH POSTPONMENTS:<br>- Baselined launch date of 10/8/98 on 7/31/97.<br>- Postponed launch date to 10/29/98 on 12/18/97.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH DELAYS:<br>- Held for 9 minutes 36 seconds during T-9 minute hold to understand the cause of the three master alarms (MA) during cabin leak checks. First MA was cabin P reached 15.35 psi during cabin leak check. Two MA's were differential pressure/differential time alarms. It was concluded that the alarms were expected and count was resumed.<br>- Held for 9 minutes 58 seconds at T-5 minutes for range safety hold call for two intruder aircraft in Launch Danger Area. Resumed count but two calls were made to hold at T-31 seconds, one for engine 2 pitch position NO GO and the second for range safety NO GO. These holds were removed before count reached T-31 seconds; hence, no additional delay.<br><br>TAL WX:<br>- Banjul, Ben Guerir, and Moron were forecast and observed GO. Banjul was prime and selected.<br><br>DOLILU/I-LOADS:<br>- DOLILU II uplink # 23, I-Load uplink # 42.<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard set plus PE High Q.<br><br>FLIGHT DURATION CHANGES: None<br><br>FLIGHT RULE WAIVER:<br>- Forecast at deorbit burn time was a maximum crosswind of 16 knots. Flight rule limit is 15 knots. Observed crosswind < 10 knots. Landed on orbit 135.<br><br>FIRSTS/LASTS/RECORDS:<br>- First flight using High Q flight design.<br>- First flight with three Block IIA SSME's (Rocketdyne HPFTP).<br>- John Glenn's first flight was Mercury-Atlas 6 on 2/20/62.<br>- Glenn's age at first flight 40Y7.5M, second flight 77Y4M, 36Y8.5M between flights.<br>- First flight using space-to-space comm system (as DTO).<br>- Second flight of Super Lightweight Tank (SLWT). |  |




STS095-328-031 (29 Oct.-7 Nov. 1998): CDR Brown (rt ctr), then clockwise, PLT Lindsey, Robinson/MS, Duque/MS/ESA, Naito-Mukai/PS/NASDA, Parazynski/MS, & Sen. Glenn/PS.



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT   | ORBITER | CREW<br>(7)             | LAUNCH SITE,<br>LIFTOFF TIME, | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-<br>ABORT<br>EMERG  | SRB<br>RSRM | ORBIT        |   | FSW  | PAYLOAD<br>WEIGHTS,      | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,                         |
|---|---------|-------------------------|-------------------------------|---|--|-------------|--------------|---|--|--------------------------|--|
| NO.   |         | TITLE, NAMES<br>& EVA'S | LANDING SITES,<br>ABORT TIMES | LANDING TIMES<br>FLT DURATION,<br>WINDS   | THROTTLE<br>PROFILE<br>ENG. S.N.   | AND<br>ET   | INC          | HA/HP   |  | PAYLOADS/<br>EXPERIMENTS | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
| STS-95<br>Continued...  |         |                         |                               | Continued...<br><br><u>DENS ALT:</u> 965 FT<br><br><u>FLT DURATION:</u><br>8:21:43:56<br><br><u>S/T:</u> 790:03:08:16<br><br><u>QV-103:</u><br>186:13:31:48<br><br><u>DISTANCE:</u><br>3,644,459 sm |  |             | Continued... |   | RMS 51<br>(S.N. 201)<br>RMS used for<br>SPARTAN-201<br>deploy, retrieve and<br>berth, ACVS,<br>OSVS, and VGS<br>OPS. | Continued...             |  |
|    |         |                         |                               | S98-16165 (10-29-98) --- In MCC: From left, CAPCOMS Susan Still &, Scott J. Horowitz; & Flight Directors Jeffrey W. Bantle, Linda Ham and Wayne Hale following launch of STS-95.                    |  |             |              | EVENTS:<br>- SPARTAN-201 release 305:19:00:12Z, 2:23:40:36 MET.<br>- Due to drag chute anomaly, drag chute was not armed and deployed.<br>- Inert weight adjustment -200 lbs included in STS OPR chargeable.<br>- SPARTAN capture 307:20:47:49Z, 5:01:28 MET.<br>Berth 5:01:46 MET.<br><br>RENDEZVOUS # 43:<br>- Deployed, separated, rendezvoused with SPARTAN-201.<br><br>RADIATOR DEPLOY # 23<br>- Both port and starboard panels deployed.<br><br>SIGNIFICANT ANOMALIES:<br>- Low Iodine Residual System (LIRS) large spraying leak. Used backup galley iodine removal system.<br>- Unpleasant taste (rubber hose) from LIRS.<br>- During space-to-space comm tests, no data from EMU 1 in primary.<br>- Drag chute door fell off during ME throttle up at T-5 seconds; hence, not deployed during landing.<br>- Decision made to disable chute for STS-88.<br>- WSB 2 overcooled six times during entry.<br>- SPARTAN ground command problem.<br>- RCS jet L3L failed off, then failed leak. |  |                          |  |
|    |         |                         |                               |   |  |             |              |   |  |                          |  |
| 98-E-03312 (14 April 1998) --- President Bill Clinton (at lectern) addresses JSC employees. Seated behind him (from left): JSC Director George W.S. Abbey, U.S. Rep. Nick Lampson (D.-TX), NASA Administrator Daniel Goldin and Houston Mayor Lee Brown. Standing are STS-95 crew: (from left) Pedro Duque, Chiaki Mukai, U.S. Sen. John H. Glenn Jr. (D.-Ohio), Stephen K. Robinson, Scott E. Parazvnski. PLT Steven W. Lindsev & CDR Curtis L. Brown. |         |                         |                               |   |  |             |              | <br>S95E5077 1998.11.01 02:09.49<br><br>STS095-E-5077 (11-01-98)- Spartan201-05 departs discovery as a free flyer for several days recording solar wind and sun corona data.   |  |                          |  |



# SPACE SHUTTLE MISSIONS SUMMARY







| FLT NO.   | ORBITER                                   | CREW (6)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br><br>AND<br>ET  | ORBIT        |  | FSW   | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|---|--|---|---|---|--------------|--|---|---|--|
| STS-88/<br>ISS-2A<br><br>First Shuttle<br>Flight to ISS | OV-105<br>(Flight 13)<br>Endeavour        | CDR:<br>Robert D. Cabana<br>(Flt 4 - STS-41, STS-53, &<br>STS-65)<br>P546/R113/V84/M101   | KSC 39, PAD A<br>338:08:35:34Z<br>3:35:34 AM EST (P)<br>3:35:34 AM EST (A)<br>Friday 18<br>12/4/98 (5)   | KSC 15 (KSC 46)<br>350:03:53:30Z<br>10:53:30 PM EST<br><br>Tuesday 14<br>12/15/98 (10)  | 104.5/104.5/<br>109%<br><br><u>PREDICTED</u><br>100/104.5/<br>104.5/72/<br>104.5<br><br><u>ACTUAL</u><br>100/104.5/<br>104.5/72/<br>104.5<br>1 = 2050 (1)<br>2 = 2044 (2)<br>3 = 2041 (5)<br><br>ALL BLOCK<br>IIA SSME'S  | BI-095<br><br>RSRM<br>67<br><br>ET-97<br><br>SLWT-3<br><br><u>SLWT</u><br><u>RPT</u><br>283K<br><br><u>SLWT</u><br><u>BR/UP</u><br>207K | 51.60<br>(1) | DIRECT<br>INSERTION<br><br><u>POST OMS-2</u><br>175 X 97 NM<br><br><u>DEPLOY:</u><br><br><u>SEP BURN:</u><br>347:21:49Z<br>213.1 X 209<br>NM<br><br><u>RCS-2</u><br><br><u>COLLISION</u><br><u>AVOIDANCE</u> | OI-26B<br>(4)<br><br><u>CARGO:</u><br>37731 LBS<br><br><u>PAYLOAD</u><br><u>CHARGABLE:</u><br>30986 LBS<br><br><u>DEPLOYED:</u><br>26791 LBS<br><br><u>NON-DEPLOYED:</u><br>3073 LBS<br><br><u>MIDDECK:</u><br>1122 LBS<br><br><u>SHUTTLE</u><br><u>ACCUMULATED</u><br><u>WEIGHTS:</u><br><u>DEPLOYED:</u><br>877846 LBS<br><u>NON-DEPLOYED:</u><br>1378355 LBS<br><u>CARGO TOTAL:</u><br>2824652 LBS<br><br><u>PERFORMANCE</u><br><u>MARGINS (LBS):</u><br>FPR: 3783<br>FUEL BIAS: 720<br>FINAL TDDP: 2365<br>RECON: 1043<br><br><u>PAYLOADS:</u><br><u>PLB:</u><br>ISS - 2A<br>Node 1/PMA 1&2<br>(Deployed to ISS)<br>ICBC<br>Mighty Sat<br>(Deployed)<br>SAC-A (Deployed)<br>GAS (1), SEM<br>RMS, ODS<br><br><u>MIDDECK:</u><br><u>SIMPLEX</u><br><br>5 CYRO TK SETS<br>6 GN2 TANKS<br><br>RMS 52<br>RMS used to<br>grapple Node 1 and<br>position on ODS.<br>Grapple FGB and<br>dock with Node 1. | <u>Brief Mission Summary:</u> The STS-88/2A "Unity" mission was the first manned ISS assembly flight. The primary mission objective was to rendezvous with the already launched Zarya control module and successfully attach the Unity connecting module. This mission provided the foundation for assembly of future ISS components.<br><br>KSC W/D: OPF 187, VAB 5, PAD 37 = 229 days<br><br><u>LAUNCH POSTPONEMENTS:</u><br>- Baselined launch date of 12/4/97 on 6/21/96.<br>- Postponed launch date to 7/9/98 on 5/27/97.<br>- Postponed launch date to 12/3/98 on 6/4/98.<br><br><u>LAUNCH SCRUBS:</u><br>- Scrubbed 12/3/98 launch attempt after LO <sub>2</sub> drainback hold time of 3M42S expired based on preferred launch time (PLT) 5-minute window (LO <sub>2</sub> drainback hold time was 5M19S based on T-0 at PLW opening and 3M42S nominal T-0 at PLT). The Planar Launch Window was 7M48S (opened at 337:08:55:31 and closed at 337:09:03:19). Opted for use of the Preferred Launch Time of 377:08:58:19 which provided a window of 5M00S. An unexpected master alarm (MA), associated with hydraulic system 1 momentary pressure spike, caused an automatic hold at T-4 minutes. After holding at T-4 minutes for 3 minutes, the count was resumed. at T-31 seconds, another hold was called while troubleshooting the MA. Resolution of the MA occurred slightly after the expiration of the 3M42S LO <sub>2</sub> drainback hold time. The count was resumed; however, the launch window had expired. Post-flight, it was concluded that the most probable cause of the pressure spike was a "Switch Tease" which momentarily reenergized the systems 1 hydraulic pump pressure solenoid valve.<br><br><u>SHUTTLE NIGHT LAUNCH #20</u><br><br><u>LAUNCH DELAYS:</u> None. Launched on-time at 338:08:35:34Z, 3:35:34 AM EST, on Friday, December 4, 1998.<br><br><u>TAL WX:</u><br>- Zaragoza (prime) forecast and observed NO GO (ceiling and crosswind), Moron (selected) forecast and observed GO. Ben Guerir forecast NO GO (ceiling & rain) but observed GO.<br><br><u>DOLILU-II I-LOADS:</u><br>- Uplink #24, I-Load uplink #43.<br><br>Continued... |  |
| SEQ FLT #93<br><br>KSC-93                               | OMS PODS<br>LPO4-20<br>RPO1-27<br>FRC5-13 | PLT:<br>Frederick W. Sturckow<br>P547/R247/M215<br><br><u>M/S 1/EV 1:</u><br>Jerry L. Ross<br>(Flt 6 - STS-61-B, STS-27,<br>STS-37, STS-55, & STS-74)<br>P548/R89/V38/M80<br><br><u>M/S 2:</u><br>Nancy J. Currie<br>(Flt 3 - STS-57, STS-70)<br>P549/R165/V120/F21<br><br><u>M/S 3/EV 2:</u><br>James H. Newman<br>(Flt 3 - STS-51, STS-69)<br>P550/R168/V122/M146<br><br><u>M/S 4:</u><br>Sergei Krikalev<br>(Russia)<br>(Flt 2 - STS-60)<br>P551/R176/V154/M154<br><br>SS EVA #42:<br>EMU/Tethered<br>EVA #35<br>Scheduled EVA #36 on<br>12/7/98<br>Duration 7H21M<br>EVA start at 3D13H34M MET<br><br>SS EVA #43:<br>EMU/Tethered<br>EVA #36<br>Scheduled EVA #37 on<br>12/9/98<br>Duration 7H02M<br>EVA start at 5D11H57M30S<br>MET<br><br>SS EVA #44:<br>EMU/Tethered<br>EVA #37<br>Scheduled EVA #38 on<br>12/12/98<br>Duration 6H59M<br>EVA start at 8D11H57M50S<br>MET<br><br>Continued... | <u>LAUNCH WINDOW</u><br>4M59S Based on<br>Preferred Launch<br>Time and FGB<br>Planar/Phase.<br><br><u>EOM PLS:</u> KSC<br><u>TAL:</u> ZZA<br><u>TAL WX:</u> MRN, BEN<br><br><u>SELECTED:</u><br><u>RTLS:</u> KSC 33/N/N<br><u>TAL:</u> MRN 20/N/N<br><u>AOA:</u> KSC 33<br><u>PLS:</u> KSC 33/N/N<br><br><u>TDEL:</u><br>-0.15 -0.008/-0.03<br><br><u>MAX Q NAV:</u><br>707 715<br><br><u>SRB STG:</u><br>2:05.3 2:05<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (ZZA):</u><br>2:25 2:25<br><br><u>NEG RETURN:</u><br>3:55 3:55<br><br><u>PTA (U/S 500):</u><br>4:48 4:45<br><br><u>DROOP:</u><br>N/A 5:24<br><br><u>PTM (U/S 273):</u><br>5:57 5:56<br><br><u>MECO CMD:</u><br>8:22.8 8:22.6<br><br><u>VI:</u><br>25931 25929<br><br><u>OMS-2 TIG:</u><br>43:38 43:41<br>103 FPS 103 FPS | <u>DEORBIT BURN:</u><br>350:02:48:04<br>340 FPS<br><br><u>XRANGE:</u> 134 NM<br><br><u>ORBIT DIR:</u> AL 22<br><br><u>AIM PT:</u> NOMINAL<br><br><u>MLGTD:</u> 3163 FT<br>350:03:53:30Z<br>VEL: 197 KGS<br>197 KEAS<br>HDOT: -2.3 FPS<br><br><u>TD NORM 195:</u><br>3293 FT<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u><br>CHUTE WAS<br>DISABLED.<br><br><u>NLGTD:</u> 6009 FT<br>350:03:53:38Z<br>VEL: 164 KGS<br>158 KEAS<br>HDOT: -6.2 FPS<br><br><u>BRK INIT:</u> 135 KGS<br>8153 FT<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u><br>CHUTE WAS<br>DISABLED.<br><br><u>BRK DECEL FPS<sup>2</sup>:</u><br>AVE 7.7 PK 9.3<br><br><u>WHEELS STOP:</u><br>350:03:54:16Z<br>11506 FT<br><br><u>ROLLOUT:</u><br>8343 FT<br>44 SEC<br><br>Continued... | 100/104.5/<br>104.5/72/<br>104.5<br><br>1 = 2050 (1)<br>2 = 2044 (2)<br>3 = 2041 (5)<br><br>ALL BLOCK<br>IIA SSME'S<br><br><u>SLWT</u><br><u>RPT</u><br>283K<br><br><u>SLWT</u><br><u>BR/UP</u><br>207K<br><br><u>DEORBIT</u><br>213.6 X 208.8<br>NM<br><br><u>VELOCITY</u><br>25898 FPS<br><br><u>ENTRY</u><br><u>RANGE</u><br>4343 NM |    |              | s99_03770 --- In Dec 1998, assembly of the ISS began with the joining of the U.S.-built Unity Node & the Russian-built Zarya module (IMAXR camera view).   | M 3 EOM<br><br>WEIGHT:<br>201538 LBS<br><br>X CG:<br>1084.33<br><br><u>LANDING</u><br><br>WEIGHT:<br>201492 LBS<br><br>X CG:<br>1086.18<br><br><u>SLWT</u><br><u>IMPACT:</u><br>1:27:30<br>MET<br>LAT:<br>1.72°N<br>LONG:<br>127.2°W  | <u>DEORBIT</u><br>213.6 X 208.8<br>NM<br><br><u>VELOCITY</u><br>25898 FPS<br><br><u>ENTRY</u><br><u>RANGE</u><br>4343 NM  |  |







# SPACE SHUTTLE MISSIONS SUMMARY





| FLT NO.                        | ORBITER | CREW (6)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE ENG. S.N.  | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP   |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--------------------------------|---------|---|--|--|--|--------------------|--|--|-----|--|---|
| STS-88/ISS-2A<br><br>Continued |         | Continued...<br>MCC WHITE FCR (23)<br><br>FLIGHT DIRECTORS:<br>A/E/O 4 - J. P. Shannon<br>LD/O 1 - R. E. Castle<br>O 2 - P. L. Engelauf<br>PIng/O 3 - A. F. Algate<br>MOD - J. W. Bantle<br>ISS LD/O 2 - M. A. Kirasich<br>ISS/O 1 - S. P. Davis<br>ISS/PIng/O 3 - J. M. Hanley |  | Continued...<br><br>WINDS:<br>5T, 1R KTS<br>OFFICIAL:<br>3105P09<br>R2, T5 KTS<br><br>DENS ALT: -854 FT<br><br>FLT DURATION:<br>11:19:17:56<br><br>S/T: 801:22:26:12<br><br>OV-105:<br>133:04:07:58<br><br>DISTANCE:<br>4,650,000 sm |    |                    |  |  |     | Continued...<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard set plus PE High Q WIN/DEC, OMS assist 4000 lbs, 52 NM MECO, and Del Psi.<br><br><u>FLIGHT DURATION CHANGES:</u> None<br><br><u>FIRSTS/LASTS:</u><br>- First Shuttle flight to International Space Station (FGB), docked node to PMA/FGB.<br>- First ISS assembly flight.<br><br><u>SHUTTLE NIGHT LANDING #10</u><br>- Landed on orbit 186 on KSC 15.<br><br><u>EVENTS:</u><br>- STS-88/2A first International Space Station (ISS) assembly flight carried NODE, Unity.<br>- First ISS element, the FGB Zarya, was launched from Baikonar Cosmodrome by a PROTON at 324:06:40:006Z into an orbit of 191.4 X 100 NM at inclination of 51.62 degrees.<br>- STS-88/2A was the first rendezvous and docking of the ISS Program.<br>- RMS grapple of PMA-1/Node 1/PMA-2 at 339:21:54:19Z, unberth at 339:22:08:10Z, installed on ODS at 339:23:52:40Z, ungrapple at 340:00:09:30Z.<br>- RMS grapple of FGB at 340:23:47:02Z, FGB ungrapple at 341:02:43:52Z.<br>- EVA 1 start at 341:22:09:51Z, end at 342:05:30:42Z, duration 7H21M51S.<br>- ISS reboost burn start at 342:20:35:34Z, duration____.<br>- EVA 2 start at 343:20:33:04Z, end at 344:03:34:34Z, duration 7H01M30S.<br>- Node 1 (Unity) ingress at 344:19:54Z, FGB ingress at 344:21:11Z.<br>- EVA 3 start at 346:20:33:24Z, end at 347:03:32:01, duration 6H58M37S.<br>- SAC-A deployed at 9:20:15 MET.<br>- Mighty SAT deployed at 10:17:13 MET.<br>- Drag Chute was disarmed pending resolution of STS-95 Drag Chute door anomaly. (Mortar was removed.)<br>- Undock at 347:20:24:34Z.<br>- ISS Visitor time 6D17H34M20S<br><br><u>RENDEZVOUS #44</u><br>- Rendezvous and dock with ISS PMA 2 Node 1 forward port. |   |
|                                |         |   |  |  |  |                    |  |  |     |  |   |
|                                |         |   |  |    | STS088-370-006 ---Crew in U.S. -built Unity Node: Bottom row (left to right) are PLT Sturckow, CDR Cabana, & Currie/MS. Top row, Krikalev/MS (Russia), Newman/MS, & Ross/MS. |                    |  |  |     |  |   |
|                                |         | BELOW: 98e09779 In MCC on console: Scott Altman, Dominic Gorie, & Scott Horowitz .  | STS088-E-5059 (12-08-98) --- Newman (left) & Ross mated 40 cables & connectors running 76 ft between Zarya & Unity (foreground).   |  |  |                    |  |  |     |  |   |
|                                |         |   | <u>SIGNIFICANT ANOMALIES:</u><br>- Galley iodine removal assembly hose QD incompatibility.<br>- Five PLB floodlights failed.<br>- Anomalous SAFER S/N 1007 GN2 and tank pressure reading.<br>- GPS anomalies.<br>- APU 2 fuel pump drain line pressure decay.<br>- RCS jet R2D fail leak.<br>- Right Pad A heater circuit failure.<br>- Right RCS 1/2 tank isolation valves fail open.<br>- Right inboard tire pressure indication failed low.<br>- Failed portable foot restraint attachment device hatch pin came out, then broke. |  |  |                    |  |  |     |  |   |
|                                |         |   |  |  |   |                    | STS088-703-032 --- Blanketing clouds form the backdrop for the connected Zarya and Unity modules after release from Endeavour's cargo bay. |  |     |  |   |

## Page 2-115 - STS-96/2A.1

[illegible]



## Page 2-116 - STS-96/2A.1





| FLT   | ORBITER | CREW<br>(7)             | LAUNCH SITE,<br>LIFTOFF TIME,                          | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-<br>ABORT<br>EMERG   | SRB<br>RSRM | ORBIT |       | FSW   | PAYLOAD<br>WEIGHTS,      | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,   |
|---|---------|-------------------------|--|---|---|-------------|-------|-------|---|--------------------------|--|
| NO.   |         | TITLE, NAMES<br>& EVA'S | LANDING SITES,<br>ABORT TIMES                          | LANDING TIMES<br>FLT DURATION,<br>WINDS   | THROTTLE<br>PROFILE<br>ENG. S.N.  | AND<br>ET   | INC   | HA/HP |   | PAYLOADS/<br>EXPERIMENTS | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
| STS-96<br>ISS-2A.1  |         |                         | Continued...<br><br>OMS-2:<br>43:11<br>255 FPS<br>2:43 | Continued...<br><br>DENS ALT: 1321 FT<br><br>FLT DURATION:<br>9:19:13:01<br><br>S/T: 811:17:39:13<br><br>OV-103:<br>196:08:44:49<br><br>DISTANCE:<br>4,051,000 sm | <u>SIGNIFICANT ANOMALIES:</u><br>- Humidity separator B water carryover.<br>- Vestibule leakage during airlock depress.<br>- SSOR anomalies: choppy EVA comm, EVA comm squeal, SSOR noise malfunctions during EVA, EMU TLM from SSOR static.<br>- Difficulty attaching SCU 1 to DCM.<br>- Lost LG/SM retractable tether - came off fish stringer.<br>- Small equipment hook failed open - tether release from D-ring on miniworkstation.<br>- SAFER Pyro Valve Fired/Manual Isolation Valve open.<br>- F4R Thruster declared failed leak by RM. |             |       |       | Continued...<br><br>RMS USED FOR<br>EVA SUPPORT<br>AND SURVEY SVS<br>(SPACE VISION<br>SYSTEM) |                          | Continued...<br><br><u>FLIGHT DURATION CHANGES:</u> None<br>- Landed on orbit 154 as planned.<br><br><u>FIRSTS/LASTS/RECORDS:</u><br>- First flight of Functional Drag Chute with strengthened door pins after problem on STS-95 (Inconel was aluminum).<br>- First logistics/maintenance flight to ISS, Third ISS flight, 2nd Docking Flight to ISS (PMA2) Node 1 forward port.<br><br><u>SHUTTLE NIGHT LANDING # 11:</u> KSC runway 15<br><br><u>EVENTS:</u><br>- OMS assist burn 147:10:51:57Z with a duration of 2M42S.<br>- RCS MC4 at 149:02:55:17/01:16:05:35 MET.<br>- ISS ring capture 149:04:23:51Z, docking 149:04:37:38Z/01:17:47:56 MET at PMA2, Node 1 Forward Port.<br>- STARSHINE deployed at 156:07:21Z/08:20:32 MET.<br>- Crew ingressed ISS PMA2 at 149:07:00Z/01:20:10 MET.<br>- IFM: Replaced FGB Battery MIRT's, and Replaced ECOMM Transceiver and Power Distribution Box.<br>- EVA Start Time 150:16:21:36Z/03:05:31:54 MET. EVA End Time 151:00:16:36Z/03:13:26:54 MET. EVA tasks include Installation of FGB target mask, installed Orbital Transfer Device and IAPFR on PAM 1, installed Strela crane on PMA2, installed trunnion pin cover, and transferred EVA tools to Node 1.<br>- Reboost Start 154:09:36:54Z/06:22:47:11 MET. Reboost End 154:10:11:40Z, Delta V 21.8 f.p.s, altitude increased 6 nm, orbit 212.1 by 206.2 nm.<br>- Undocking complete 154:22:39:17Z/07:11:36 MET.<br>- ISS Visitor time is 5:18:01:39.<br>- Final transfers to ISS: EVA 661 lbs, IVA transfers 2881 lbs, and water transfers 686 lbs (7 CWC's), Total to ISS 4228 lbs. To Shuttle 197 lbs.<br>- Return IVA transfers to Discovery 213 lbs.<br>- Landed on orbit 154, Ascending Left 23, Crossrange 712 NM, range 4370 NM, Runway 15.<br><br><u>RENDEZVOUS # 45:</u><br>- Rendezvous and dock with ISS.<br><br><u>RADIATOR DEPLOY # 24:</u> |
|   |         |                         |  |   |   |             |       |       |   |                          |  |
| STS-96-E-5168--linflight crew portrait: At bottom center: CDR Rominger, flanked by Barry/MS & Ochoa/MS. Above Barry (left) Tokarev/MS(RSA), Jernigan/MS & Payette/MS (CSA). PLT Husband is between Payette & Ochoa. |         |                         |  |   |   |             |       |       |   |                          |  |
|   |         |                         |  |   |   |             |       |       |   |                          |  |
| STS-96-357-003 (30 May 1999) --- MS1 Jernigan totes part of a Russian-built crane, Strela (a Russian word meaning "arrow").   |         |                         |  |   |   |             |       |       |   |                          |  |
|   |         |                         |  |   |   |             |       |       |   |                          |  |
| STS-96-E-5219 --- ISS as seen from Discovery after separation.  |         |                         |  |   |   |             |       |       |   |                          |  |
|   |         |                         |  |   |   |             |       |       |   |                          |  |
| STS-96-(S)-010 --- First flight of Functional Drag Chute with strengthened door pins after STS-95 problem (door fell off at SSME throttle-up). Inconel replaced aluminum pins.                                      |         |                         |  |   |   |             |       |       |   |                          |  |



## Page 2-117 - STS-93


[illegible]


# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (5)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|---|---------|--------------------------------------|--|---|--|-----------------|--------------------|--|-----|--|---|--|
| STS-93<br><br>Continued   |         |                                      | Continued...<br><br>OMS-2:<br>41:04 41:06.9<br>200 FPS 200 FPS<br>2:14 2:14  | Continued...<br><br>WINDS:<br>04T, 5L KTS<br>OFFICIAL:<br>2405P06<br>SS: OT, 5L<br>PK: OT, 6L<br><br>DENS ALT:<br>1551 FT<br><br>FLT DURATION:<br>4:22:49:35<br><br>S/T: 816:16:28:48<br><br>OV-102:<br>273:21:09:17<br><br>DISTANCE:<br>1,796,000 sm | <br>STS093-322-017 --- Collins, first female Shuttle CDR, and crew are shown on-orbit. In front are CDR Collins and Tognini/MS (France). In rear are (from the left) Hawley/MS, Ashby/PLT, and Coleman/MS.   |                 |                    |  |     | Continued...<br><br><u>LAUNCH DELAY:</u><br>- Launch was delayed 7MOS during T-20 minute hold for MILA to change out A Frame Sync Box to restore the forward link.<br>- Launched at 204:04:31:00Z, 12:31:00 AM EDT on July 23, 1999.<br><br><u>SHUTTLE NIGHT LAUNCH #21</u><br><br><u>TAL WX:</u><br>- Banjul (prime) was forecast NO GO (thunderstorms and anvil clouds) and observed NO GO (thunderstorms and ceiling). Ben Guerir (selected) was forecast and observed GO.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard set.<br>- PE LO Q SUM/JUL<br><br><u>SHUTTLE NIGHT LANDING # 12:</u> KSC 33 on Wednesday, 7/28/99 at 11:20:35 PM EDT - moonlit landing.<br><br><u>FLIGHT DURATION CHANGES:</u> None<br>- Landed on orbit 80 as planned.<br><br><u>FIRSTS/LASTS:</u><br>- First space flight with female Commander (Eileen Collins).<br>- First U.S. flight for Michel Tognini (CNES-France). Michel's first space flight was to Mir on Soyuz TM-15S.<br>- Last flight of phase 2 engines.<br>- Most aft landing Xcg (1099.36) |   |  |
| <br>STS093-706-039 --- Chandra X-Ray Observatory after release from Columbia's payload bay. |         |                                      | <br>ABOVE: Hawley/MS shown with Micro-Electromechanical Systems (MEMS) experiment. MEMS monitors a suite of sensors under flight conditions. ABOVE RIGHT: Mark Sowa (PAO photographer) recorded the fly-over of Space Shuttle Columbia above the JSC Rocket Park. The Saturn V is below the streak left by the shuttle Columbia re-entering the atmosphere. |   | <br><u>SIGNIFICANT ANOMALIES:</u><br>- At approximately Liftoff plus 5 seconds, there was a short circuit on AC1 Phase A for approximately 0.5 seconds. The resultant under voltage caused SSME 1 "A" and SSME 3 "B" controllers to be disqualified. Postflight, it was determined the short was on AC1 Phase A to SSME 1 "A" controller.<br>- At liftoff, the right SRB hydraulic pressure sensor 2 was erratic.<br>- Four ET LO <sub>2</sub> sensors indicated dry resulting in low-level cutoff of main engines and slightly early MECO.<br>- Right SSME multiple performance parameters deviations (Post-flight inspection revealed ruptures in three Engine 2019 nozzle tubes caused by an impact of a loose LO <sub>2</sub> post deactivation pin. LH2 leak resulted in controller compensating for fuel loss with additional LOX flow, a 16 fps underspeed, and 8 nm lower altitude).<br>- CRT 3 Critical BITE.<br>- High-load FES excessive water carryover.<br>- Camcorder tape jam.<br>- Primary thruster F2D low fuel injector temperature. |                 |                    |  |     |  |   |  |



# SPACE SHUTTLE MISSIONS SUMMARY




| FLT NO.  | ORBITER   | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET  | ORBIT   |            | FSW   | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|---|---|--|---|---|---|------------|---|--|--|
| STS-103<br><br>SEQ FLT #96<br><br>KSC-96<br><br>PAD 39B-42 MLP-2<br><br>HST FLT #4 (SM-3A)<br><br>HST SERVICE FLT #3 | OV-103 (Flight 27) Discovery<br><br>OMS PODS: LPO1-30 RPO3-28 FRC3-27 | <u>CDR:</u><br>Curtis L. Brown (Flt 6 - STS-47, STS-66, STS-77, STS-85, & STS-95) P564/R152/V112/M136<br><br><u>PLT:</u><br>Scott J. Kelly P565/R253/M220<br><br><u>M/S 1/EV 1:</u><br>Steven L. Smith (Flt 3 - STS-68, STS-82) P566/R184/V137/M161<br><br><u>M/S 2:</u><br>Jean-Francois Clervoy (ESA-France) (Flt 3 - STS-66, STS-84) P567/R186/V140/F163<br><br><u>M/S 3/EV 2:</u><br>John M. Grunsfeld (Flt 3 - STS-67, STS-81) P568/R191/V133/M167<br><br><u>M/S 4/EV 3:</u><br>Michael Foale (Flt 5 - STS-45, STS-56, STS-63, Up STS-84, & Dn STS-86) P569/R143/V92/M127<br><br><u>M/S 5/EV 4:</u><br>Claude Nicollier (ESA-Switzerland) (Flt 4 - STS-46, STS-61, & STS-75) P570/R150/V98/M134<br><br>SS EVA #46 EMU/TETHERED EVA #39 ON 12/22/99 SCHEDULED EVA #40 DURATION 8:15:30<br><br>SS EVA #47 EMU/TETHERED EVA #40 ON 12/23/99 SCHEDULED EVA #41 DURATION 8:10<br><br>Continued... | KSC, PAD 39B 354:00:50:00Z 7:50:00 PM EST (P) 7:50:00 PM EST (A) Sunday 11 12/19/99 (6)<br><br><u>LAUNCH WINDOW:</u><br>42M16S HST Planar/Phase Window<br><br><u>EOM PLS:</u> KSC TAL: BYD TAL WX: BEN<br><br><u>SELECTED:</u><br>RTLS: KSC 15/N/N TAL: BEN 36/N/N AOA: EDW 04/N/N PLS: EDW 22/N/N<br><br><u>TDEL:</u><br>0.08 -0.158/-0.12<br><br><u>MAX Q NAV:</u><br>718 720<br><br><u>SRB STG:</u><br>2:05.3 2:05<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (BEN):</u><br>2:05 2:05<br><br><u>NEG RETURN:</u><br>3:51 3:54<br><br><u>PTA (U/S 500):</u><br>3:09 3:08<br><br><u>PTM (U/S 500):</u><br>4:16 4:15<br><br><u>SE TAL (BYD):</u><br>5:37 5:43<br><br><u>MECO CMD:</u><br>8:24.4 8:25.9<br><br><u>VI:</u><br>26128 26124<br><br>Continued... | KSC 33 (KSC 49) 362:00:00:47Z 7:00:47 PM EST<br><br>Monday 17 12/27/99 (11)<br><br><u>DEORBIT BURN:</u><br>361:22:48:26Z<br><br><u>XRANGE:</u> 155 NM<br><br><u>ORBIT DIR:</u> DL 46<br><br><u>AIM PT:</u> NOMINAL<br><br><u>MLGTD:</u> 2804 FT 362:00:00:47Z<br><br><u>VEL:</u> 187 KGS 186 KEAS HDOT: -2.9 FPS<br><br><u>TD NORM 195:</u><br>2237 FT<br><br><u>DRAG CHUTE DEPLOY:</u> 176 KEAS 362:00:00:50Z<br><br><u>NLGTD:</u> 5955 FT 362:00:00:58Z<br><br><u>VEL:</u> 141 KGS 138 KEAS HDOT: -4.6 FPS<br><br><u>BRK INIT:</u> 111 KGS<br><br><u>DRAG CHUTE JETTISON:</u> 54 KGS 362:00:01:18Z<br><br><u>BRK DECEL FPS<sup>2</sup>:</u><br>AVE 6.5 PK 10.0<br><br><u>WHEELS STOP:</u><br>362:00:01:35Z 9809 FT 48 SECS<br><br><u>ROLLOUT:</u><br>7005 FT<br><br>Continued... | 104/104/109%<br><br><u>PREDICTED:</u><br>100/104.5/104.5/67/104.5<br><br><u>ACTUAL:</u><br>100/104.5/104.5/67/104.5<br><br>1 = 2053 (1)<br>2 = 2043 (3)<br>3 = 2049 (2)<br><br>ALL IIA ENGINES<br><br> | BI-099 RSRM 73<br><br>ET-101 SLWT-6<br><br>ET RPT: 283K<br><br>ET IMPACT: 1:19:15 MET LAT: 17.4°N LONG: 141.4°W<br><br><b>STS103-713-048 (19-27 December 1999) --<br/>- Smith and Grunsfeld replacing gyroscopes, contained in rate sensor units (RSU), inside HST.</b> | 28.45° (49)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 315.4 X 170.2 NM | OI-26B (6) | <u>CARGO:</u><br>20276 LBS<br><br><u>PAYLOAD CHARGABLE:</u><br>13208 LBS<br><br><u>DEPLOYED:</u><br>5423 LBS<br><br><u>NON-DEPLOYED:</u><br>6451 LBS<br><br><u>MIDDECK:</u><br>1334 LBS<br><br><u>SHUTTLE ACCUMULATED WEIGHTS</u><br><u>DEPLOYED:</u><br>930577 LBS<br><u>NON-DEPLOYED:</u><br>1411877 LBS<br><u>CARGO TOTAL:</u><br>2931118 LBS<br><br><u>PERFORMANCE MARGINS (LBS):</u><br>FPR: 3783<br>FUEL BIAS: 720<br>FINAL TDDP: 13576<br>RECON: 13308<br><br><u>PAYLOADS</u><br><u>PLB:</u><br>HST SM-3A (3rd HST Service Flight)<br><br>5 CYRO TK SETS<br>6 GN2 TANKS<br><br>RMS 54 (S.N. 301)<br><br>RMS USED FOR HST GRAPPLE, BERTH, AND RELEASE AND EVA SUPPORT | <u>Brief Mission Summary:</u> The STS-103 mission was the third Servicing Mission to ensure the health of the Hubble Space Telescope (HST), the first of NASA's "Great Observatories". Included were four spacewalks designed to install new equipment and replace old. The primary objective was to replace the six gyroscopes to restore the three Rate Sensor Units to full power. Other replacements included: an upgraded computer, a set of Fine Guidance Sensors, and a new Solid State Recorder. Deteriorated insulation on the HST's outer surface was also repaired.<br><br>KSC W/D: OPF 141, VAB 9, PAD 36 = 186 days<br><br><u>LAUNCH POSTPONEMENTS:</u><br>- Baseline 10/14/99 as launch date on 3/18/99.<br>- Postponed launch to 11/19/99 on 9/16/99. OV-103 wire inspections and repair.<br>- Postponed launch to 12/2/99 on 10/22/99. OV-103 wire inspections and repair.<br>- Postponed launch to 12/6/99 on 11/10/99. OV-103 wire inspections and repair.<br>- Postponed launch to 12/11/99 on 12/7/99. Replacement of damaged SSME wiring harness.<br>- Postponed launch to 12/16/99 on 12/9/99. Changeout of dented LH2 4-in Recirc manifold.<br><br><u>LAUNCH SCRUBS:</u><br>- Scrubbed 12/16/99 launch attempt at 9:18 AM EST at ET Tanking MMT while holding at T-6 hours. ET weld wire issue caught by vendor X-ray inspection. ET cleared ET hardware. Orbiter needed 24 hours to review orbiter weld processes and personnel records to evaluate possible impact to orbiter hardware. Review found no issue to orbiter fleet. Reset launch to 12/17/99. Technical Scrub.<br>- Scrubbed 12/17/99 launch attempt at 8:47 PM EST at 4 minutes into window due to KSC range and RTLS weather. Weather concerns were low ceiling (broken 6500 feet), rain, turbulence, thick cloud layer (triggered lightning), and RTLS crosswinds at limit. Had difficulty getting Jimsphere balloons to altitude due to icing conditions. Use of 450 MHz radar profiler as backup confirmation of wind persistence was being worked. EDW runway distance lighting markers power failure. FD switched to NOR for AOA and first day PLS. Launch was scrubbed when it became evident bad weather conditions would continue throughout the remainder of the window. Ben Guerir and Banjul TAL sites were GO. Ben Guerir was selected. Reset launch to 12/18/99. Window was 42M11S first pane, 10 second cutout, and then 4M11S in second pane. Weather Scrub.<br><br>Continued... |  |








# SPACE SHUTTLE MISSIONS SUMMARY

| FLT                      | ORBITER | CREW<br>(7)  | LAUNCH SITE,<br>LIFTOFF TIME,  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-ABORT<br>EMERG   | SRB<br>RSRM | ORBIT   |       | FS<br>W  | PAYLOAD<br>WEIGHTS,      | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,   |  |
|--------------------------|---------|--|--|---|---|-------------|---|-------|--|--------------------------|--|--|
| NO.                      |         | TITLE, NAMES<br>& EVA'S  | LANDING SITES,<br>ABORT TIMES  | LANDING TIMES<br>FLT DURATION,<br>WINDS   | THROTTLE<br>PROFILE<br>ENG. S.N.  | AND<br>ET   | INC   | HA/HP |  | PAYLOADS/<br>EXPERIMENTS | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |  |
| STS-103<br><br>Continued |         | Continued...<br><br>SS EVA #48<br>EMU/TETHERED<br>EVA #41 ON 12/24/99<br>SCHEDULED EVA #42<br>DURATION 8:09<br><br>MCC WHITE FCR (26)<br><br>FLIGHT DIRECTORS:<br>A/E/O 4 - N. W.Hale<br>LD/O 1 - L. J. Ham<br>O 2 - B. P. Austin<br>Plng - J. M. Hanley<br>MOD - J. W. Bantle | Continued...<br><br>OMS-2:<br>44:15                      44:08<br>252 FPS                247 FPS<br>2:34                      2:34<br><br>DISTANCE:<br><br>WINDS:<br>1T, 7L KTS<br>OFFICIAL:<br>2406P12<br><br>DENS ALT: -107 FT<br><br>FLT DURATION:<br>7:23:10:47<br><br>S/T: 824:15:39:35<br><br>OV-103:<br>204:07:55:46<br><br>DISTANCE:<br>3,267,360 sm | Continued...<br><br><br><br>STS103-397-035 -- Crew portrait. Front: (lt to rt) Nicollier/MS(ESA), PLT Kelly, & Grunsfeld/MS. Back row: (lt to rt) Smith/MS, Foale/MS, CDR Brown, & Clervov/MS(ESA). |  |             | STS103-726-081 (19-27 December 1999) --- Repaired HST after release from RMS. |       |  |                          | S99-15923 --View of JSC MCC during Flight Day 3 activity. Lead Orbit 1 FD Linda Ham is at rear right.  |  |
|                          |         |  |  |   |   |             |   |       |  |                          | Continued... <u>LAUNCH SCRUBS:</u><br><br>- Scrubbed 12/18/99 launch attempt at 8:21 AM EST at ET Tanking MMT while holding at T-6 hours due to observed and forecast bad Range and RTLS weather: Rain, low ceiling, and thick clouds triggered lightning conditions. Decision to evaluate 8 + 2, 3 EVA flight, evaluate landing as late as 12/29/99, and vehicle configuration for holiday shutdown. At MMT Meeting at 8:30 AM EST on 12/19/99, decision was made to recommend GO for launch on 12/19/99 at 7:50 PM EST. Weather forecast was good and ET MMT gave a GO to tank. Range and RTLS Weather Scrub.<br><br><u>LAUNCH WINDOW:</u><br>Launch window 42M16S in one pane.<br><br><u>LAUNCH DELAYS:</u> None<br>- Launched at 354:00:50:00Z (GMT date 12/20/99), 7:50:00 PM EST, on Friday, 12/19/99.<br><br><u>TAL WX:</u><br>- Banjul (prime) was forecast and observed NO GO with visibility 3 miles (smoke/haze). Ben Guerir (selected) was forecast and observed GO.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard set. PE LO Q WIN/DEC<br><br><u>SHUTTLE NIGHT LAUNCH #22</u><br><br><u>FLIGHT DURATION CHANGES:</u><br>- Planned landing at KSC on orbit 119. Extended flight one orbit for weather. Waved off landing at KSC on orbit 119 due to crosswinds of 18 knots, peak 19 knots and STA reported turbulence at 500 feet. Landed on KSC 33 on orbit 120.<br><br><u>SHUTTLE NIGHT LANDING #13</u><br>- Landed on KSC 33 on orbit 120 at 362:00:00:47Z, 7:00:47 PM EST on Monday, December 27, 1999.<br><br><u>EVENTS:</u><br>- HST grapple at 356:00:34:01Z; HST berth 356:01:42:00Z.<br>- EVA-1 - Start at 356:18:41:01Z; MET 02:18:04:40 to 03:02:19 MET; duration 8:15:30.<br>- EVA 2 - Start MET 03:18:16 to 04:02:26; duration 8:10.<br>- EVA 3 - MET 04:13:27 to 05:02:36; duration 8:09.<br>- HST unberth at 359:21:18:41Z; HST release 359:23:03:01Z.<br><br><u>RENDEZVOUS # 46:</u><br>- Rendezvous, capture, service, and release HST. |  |
|                          |         |  |  |   |   |             |   |       |  |                          | <u>SIGNIFICANT ANOMALIES:</u><br>- Jammed PFR roll joint.<br>- Loss of power indication on middeck EMU battery charger.<br>- HST PFR pitch joint would not lock.<br>- Release hatch Pip Pin on Starboard Airlock hinge.<br>- EMU 2 Power up failure.<br>- Bent pin on EMU3 DCM.  |  |


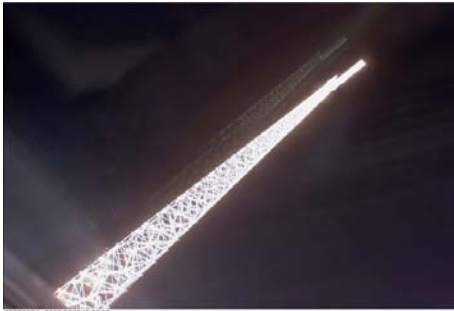
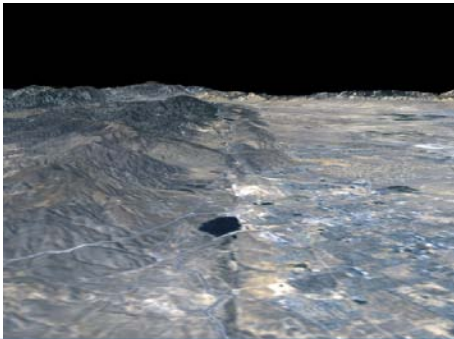

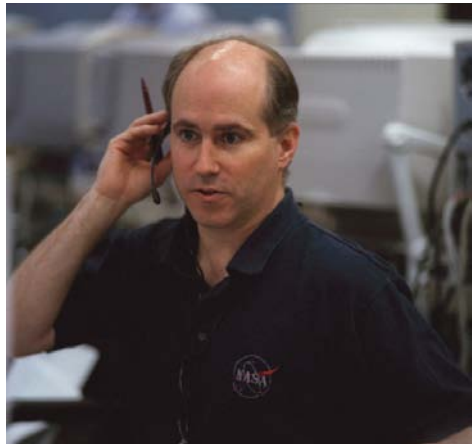
# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER   | CREW (6)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET                                  | ORBIT   |  | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|---|---|---|--|--|---|--|--|--|---|
| STS-99<br><br>SEQ FLT #97<br><br>KSC-97<br><br>PAD 39A-55<br>MLP-3 | OV-105 (Flight 14)<br>Endeavour<br><br>OMS PODS:<br>LPO4-21<br>RPO1-28<br>FRC5-14 | CDR:<br>Kevin R. Kregel (Flt 4 - STS-70, STS-78, & STS-87)<br>P571/R197/V129/M172<br><br>PLT:<br>Dom L. Gorie (Flt 2 - STS-91)<br>P572/R242/V157/M211<br><br>M/S 1:<br>Gerhard P. J. Thiele<br>ESA Germany<br>P573/R254/M221<br><br>M/S 2:<br>Janet L. Kavandi (Flt 2 - STS-91)<br>P574/R243/V158/F32<br><br>M/S 3:<br>Janice Voss (Flt 5 - STS-57, STS-63, STS-83,& STS-94)<br>P575/R167/V115/F22<br><br>M/S 4:<br>Mamoru Mohri<br>Japan (Flt 2 - STS-47)<br>P576/R155/V159/M137<br><br><br>MCC WHITE FCR (27)<br><br>FLIGHT DIRECTORS:<br>A/E - J. P. Shannon<br>LD/O2 - P. F. Dye<br>O-1 - L. E. Cain<br>O3 - B. P. Austin<br>MOD - J. M. Heflin | KSC 39A<br>42:17:43:40Z<br>12:30:00 PM EST (P)<br>12:43:40 PM EST (A)<br>Friday 20<br>2/11/2000 (7)<br><br>LAUNCH WINDOW:<br>2H10M Closed on SRTM BETA ANGLE CONSTRAINT<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN,BEN<br><br>SELECTED:<br>RTLS: KSC 33/C/N<br>TAL: ZZA 30/N/N<br>AOA: NOR 23/C/N<br>PLS: EDW 22/C/N<br><br>TDEL: 0.12 -0.38/-0.04<br><br>MAX Q NAV: 727 733<br><br>SRB STG: 2:05.6 2:06<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA): 2:48 2:46<br><br>NEG RETURN: 3:52 3:55<br><br>PTA (U/S 187): 5:26 5:21<br><br>DROOP(ZZA): 5:16 N/A<br><br>PTM (U/S 187): 6:15 6:11<br><br>SE TAL (ZZA): 6:03<br><br>MECO CMD: 8:22.5 8:23.42<br><br>VI: 25776 25769<br><br>Continued... | KSC 33 (KSC 50)<br>53:23:22:24Z<br>6:22:24: PM EST<br><br>Tuesday 15<br>2/22/2000 (5)<br><br>DEORBIT BURN: 53:22:25:10Z<br><br>X RANGE: 242 NM<br>ORBIT DIR: DL 47<br><br>AIM PT: NOMINAL<br>MLGTD: 2885 FT<br>53:23:22:24:Z<br>VEL: 206 KGS<br>HDOT: -1.6 FPS<br><br>TD NORM 205: 3004 FT<br><br>DRAG CHUTE<br>DEPLOY: 166 KEAS<br>53:23:22:36Z<br><br>NLGTD: 6520 FT<br>53:23:22:34Z<br>VEL: 169 KGS<br>168 KEAS<br>HDOT: -65 FPS<br><br>BRK INIT: 115 KTS<br><br>DRAG CHUTE<br>JETTISON: 52 KGS<br>53:23:23:05Z<br><br>AVE BRK DECEL: AVE 5.9 PK 7.8 FPS/S<br><br>WHEELS STOP: 53:23:22:23:Z 12828 FT<br><br>ROLLOUT: 9943 FT 59 SEC<br><br>WINDS: 1R, 7R KTS<br><br>OFFICIAL: 0507P09<br>SS: 2T, 7R<br>PK: 3T, 12R<br><br>DENS ALT: 72 FT<br><br>Continued... | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>1 = 2052 (1)<br>2 = 2044 (3)<br>3 = 2047 (3)<br>ALL BLOCK<br>IIA SSME'S<br><br>JSC2000E01556 (January 2000) --- Artist's concept of SRTM Earth mapping operation.<br> | BI-100<br><br>RSRM 71<br><br>ET-92<br><br>LWT 85 | 57.0 (20)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 129.5 X 126.1 NM<br><br>RCS OA<br>MANEUVER<br>4:14:00<br>MET: 126.5 X 128.7 NM | 01-27 (2)<br><br>CARGO: 35410 LBS<br><br>PAYLOAD CHARGEABLE: 29069 LBS<br><br>DEPLOYED: 260 LBS<br><br>NON-DEPLOYED: 26987 LBS<br><br>MIDDECK: 1822 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: 930837 LBS<br>DEPLOYED: 1440686 LBS<br>NON-DEPLOYED: 2966528 LBS<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 3272<br>FUEL BIAS: 854<br>FINAL TDDP: 1085<br>RECON: 395<br><br>PAYLOADS: PLB:<br><br>SRTM/SRL-3 with radar antennas on 200 ft boom.<br><br>MIDDECK: EARTHKAM | <b>Brief Mission Summary:</b> STS-99 was the first shuttle flight of the new century. The primary payload was a space radar, known as Shuttle Radar Topography Mission (SRTM). The SRTM successfully mapped the Earth in 3-D, 30 times more accurately than current global maps. The system used two radar antennas mounted in the shuttle payload bay and two on a 200-foot-long mast extended out of the payload bay. This mast was the longest rigid structure deployed in space at this time. The SRTM is an outgrowth of the Spaceborne Imaging Radar flown on STS-59 and STS-68.<br><br>KSC W/D: OPF 257, VAB 10, PAD 44 = 311 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 6/30/99 on 3/5/98 (OV-104); then to 1/22/99 on 6/4/98 (Multi-flight changes ISS SM delay).<br>- Advanced launch date to 9/16/99 on 7/23/98. OV-104, OV-103 on 7/30/98 to achieve additional GPS DTO Flight. Updates to flight dates and baseline STS-101 OV-105 on 10/5/98.<br>- Postponed launch date to NET 11/19/99 on 9/16/99.<br>STS-103 also NET 11/19/99 due to wire inspections and repairs.<br>- Postponed launch date to 1/13/00; additional wire work and STS-103 to fly first.<br>- Postponed launch date to 1/31/00. STS-103 flight delays and Y2K testing.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 1/31/00 launch attempt at 31:19:08:55Z (T-9M12S) with 40M05S left in 2H02M launch window while counting to T-9 minutes. At T-29 minutes, a preflight BITE test to the MEC's was executed. MEC 2 (an EMEC) first response was anomalous (bad address, bad parity, bad SEV). Scrub at 19:08:55Z (T-9M12S). Decision on a 2/1/00 launch at MMT early Tuesday morning. The Range and RTLS was observed and forecast NO GO for 1/31 launch (low ceiling, rain within 20 NM, field mills in and out, thick cloud layer, and triggered lightning potential). All 3 TAL sites were GO. Technical/ Weather Scrub. New launch date 2/1/00 at 12:44 PM EST.<br>- Scrubbed 2/1/00 launch attempt at approximately 3:00 AM EST with the decision to change out MEC 2. MEC changeout and retest is 5 to 7 days. Tried to get range for 2/9/00. MCC changeout/retest and range availability set next launch to 2/11/00. Technical scrub.<br><br>LAUNCH WINDOW:<br>- The Launch Window was 2H10M00S. Opened at 42:17:30:00Z and closed at 42:19:40Z. Closed on 0 degrees beta angle constraint for SRTM operations.<br><br>Continued... |  |   |





# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (6)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.                                 | SRB RSRM AND ET   | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|--------------------------------------|---|---|--|---|-------|--|-----|---|---|
| STS-99<br><br>Continued   |         |                                      | Continued...<br><br>OMS-2:<br>34:59.5 181 FPS<br>35:03 181 FPS  | Continued...<br><br>FLT DURATION:<br>11:05:38:44<br>S/I: 835:21:18:19<br>OV-105:<br>144:09:46:40<br>DISTANCE:<br>4,708,821 sm |  |   |       |  |     | Continued...<br><br><u>LAUNCH DELAYS:</u><br>- Launch delay was 13M40S. Held at T-9 minutes hold to clear the IPR's: (1) MPS LH2 manifold P, (2) cabin pressure leak check at lower pressure, and (3) Hyd Sys 1 Circ Pump pressure low. Launched at 42:17:43:40Z, 12:43:40 PM EST, on Friday, February 11, 2000.<br><br><u>TAL WX:</u><br>- Zaragoza (prime and selected); Moron (2-engine TAL Call), and Ben Guerir were all forecast and observed GO.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard Set plus: (1) Interim generic High Q WIN/FEB, and (2) OMS Assist is 4000 lbs.<br><br><u>FLIGHT DURATION CHANGES:</u> Extended One Rev due to Crosswind Violations at KSC. Waved off landing on orbit 181.<br><br><u>FIRSTS/LASTS:</u><br>- First shuttle flight in the year 2000.<br>- First flight of Shuttle Radar Topography Mission using dual-antenna imaging radar with antennas mounted on 200 foot extended boom.<br>- Last flight of Lightweight ET.<br><br><u>EVENTS:</u><br>- Landed on KSC runway 33 on orbit 182 at 53:23:22:24Z, 6:22:24 PM EST on Tuesday, 2/22/00.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- GPC I/O Errors and EMEC preflight BITE error.<br>- LH2 Manifold Pressure Tape Meter Oscillations.<br>- WSB 2 under cool during ascent.<br>- CRT 1 BITE.<br>- ET GH2 Ullage Pressure Low at MECO.<br>- Forward Mission Timer Display Elements Failed.<br>- RRCS Fuel Regulator B Primary Stage Leakage.<br>- Vernier Thruster L5D Oxidizer Temperature Erratic.<br>- Supply water dump nozzle blockage.<br>- APU 1 GG Injector tuber temperature failure. |   |
|   |         |                                      | S99-E-5034 (12 February 2000)--- The 200 ft.-long mast supporting the Shuttle Radar Topography Mission juts into space from Endeavour (out of frame at left).   |   |  | STS099-318-015 --- A "star-burst" pose. Top Center: Voss/MS, (clockwise from her) PLT Gorie, Kavandi/MS, Thiele/MS (ESA), Mohri/MS (NASDA), and CDR Kregel. |       |  |     |   |   |
|  |         |                                      | JSC2000-E-02781 PIA02733 (Release Date: 21 February 2000) --- Perspective view of San Andreas Fault near Palmdale, CA. The view was created by draping a Landsat satellite image (showing residential and agricultural development) over an SRTM elevation model. Topography is exaggerated 1.5 times vertically. |   |  |   |       |  |     | <u>ABOVE:</u> JSC2000-01451 -- SRTM personnel support STS-99 in JSC Payload Operations Control Center (POCC). From left are Mike Kobrick, Ian Joughin and Diane Ainsworth.<br><u>ABOVE RIGHT:</u> JSC2000-01454 --- Scott D. Vangen "talks topography" at the Crew Interface Console (CIC) in JSC POCC.   |   |




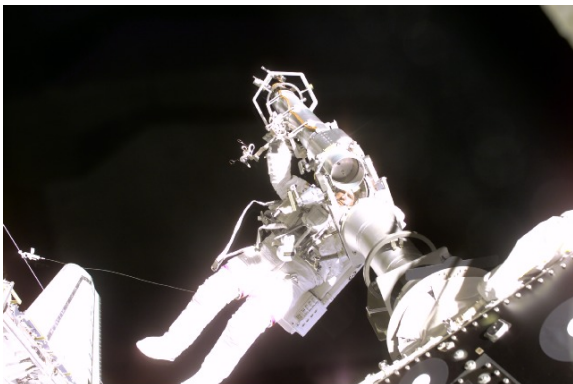


# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER   | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET<br>ET<br>IMPACT<br>LAT:<br>LONG:   | ORBIT<br>INC<br>HA/HP                   | FSW   | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---|--|--|---|---|---|---|---|---|--|
| STS-101/<br>ISS 2A.2a<br><br>SEQ FLT #98<br><br>KSC-98<br><br>PAD<br>39A-56<br>MLP-1<br><br>THIRD<br>SHUTTLE<br>FLIGHT TO<br>ISS<br><br>SPACEHAB<br>#14 | OV-104<br>(Flight 21)<br><br>Atlantis<br><br>OMS PODS:<br>LPO3-25<br>RPO4-21<br>FRC4-21 | CDR:<br>James D. Halsell<br>(Flt 5 - STS-65, STS-74,<br>STS-83, STS-94)<br>P577/R178/V123/M156<br><br>PLT:<br>Scott J. Horowitz<br>(Flt 3 - STS-75, STS-82)<br>P578/R210/V135/M183<br><br>M/S 1:<br>Mary Ellen Weber<br>(Flt 2 - STS-70)<br>P579/R198/V160/F26<br><br>M/S 2/EV1:<br>Jeffrey N. Williams<br>P580/R255/M222<br><br>M/S 3/EV2:<br>James S. Voss<br>(Flt 4 - STS-44, STS-53,<br>STS-69)<br>P581/R136/V85/M121)<br><br>M/S 4:<br>Susan J. Helms<br>(Flt 4 - STS-54, STS-64,<br>STS-78)<br>P582/R158/V108/F19<br><br>M/S 5:<br>Yuri Usachev<br>(Russia)<br>P583/R256/M223<br><br>SSEVA #49<br>EMU TETHERED<br>EVA #42<br>SCHEDULED EVA #43<br>DURATION 6:44<br><br>MCC WHITE FCR (28)<br>FLIGHT DIRECTORS:<br>A/E - J. P. Shannon<br>LD/O1 - P. L. Engelauf<br>O2 - K. B. Beck<br>PLNG - C. W. Shaw<br>PLNG/O2 - L. E. Cain<br>(Beck, Shaw, and Cain<br>switched shifts during flight.)<br><br>ISS LD/O1 - P. S. Hill<br>ISS O2 - A. F. Algate<br>ISS PLNG - J. M. Curry<br>MOD - J. W. Bantle | KSC 39A<br>140:10:11:10Z<br>6:11:10 AM EDT (P)<br>6:11:10 AM EDT (A)<br>Friday 21<br>5/19/00 (6)<br><br>LAUNCH WINDOW:<br>5M4S BASED ON<br>ISS IN-PLANE TIME<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 15/C/N<br>TAL: ZZA 30/C/N<br>AOA: KSC 15/C/N<br>PLS: EDW 04/N/SF<br><br>TDEL:<br>0.09 -0.388/-0.19<br><br>MAX Q NAV:<br>714 709<br><br>SRB STG:<br>2:04.8 2:04<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA):<br>2:27 2:27<br><br>NEG RETURN:<br>3:52 3:56<br><br>PTA (U/S 269):<br>4:42 4:47<br><br>DROOP (ZZA):<br>5:26 5:28<br><br>PTM (U/S 269):<br>5:59 6:06<br><br>SE TAL (ZZA):<br>6:02 6:02<br><br>MECO CMD:<br>8:23.8 8:25.3<br><br>VI:<br>25931 25930<br><br>OMS-2:<br>43:04 43:04<br>81.3 FPS 81.4 FPS | KSC 15 (KSC 51)<br>150:06:20:19Z<br>2:20:19 AM EDT<br><br>Monday 18<br>5/29/00 (9)<br><br>DEORBIT BURN:<br>150:05:12:10Z<br><br>X RANGE: 95.8 NM<br><br>ORBIT DIR: AL 24<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3269 FT<br>150:06:20:19 Z<br>VEL: 202 KGS<br>199 KEAS<br>HDOT: -2.0 FPS<br><br>TD NORM 205:<br>2731 FT<br><br>DRAG CHUTE<br>DEPLOY: 189 KEAS<br>150:06:20:22 Z<br><br>NLGTD: 6752 FT<br>150:06:20:30 Z<br>VEL: 154 KGS<br>152 KEAS<br>HDOT: -4.2 FPS<br><br>BRK INIT: 102 KGS<br><br>DRAG CHUTE<br>JETTISON: 54 KGS<br>150:06:20:57 Z<br><br>BRK DECEL (fps/s):<br>AVE 5.3 PK 6.6<br><br>WHEELS STOP:<br>150:06:21:07 Z<br>12182 FT<br><br>ROLLOUT:<br>8913 FT<br>48 SEC<br><br>WINDS:<br>2407P09<br>SS:OH 7R<br>PK:IH 9R<br><br>DENS ALT:<br>1591 FT<br><br>Continued... | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>96/72/<br>104.5<br><br>1 = 2043 (4)<br>2 = 2054 (1)<br>3 = 2049 (3)<br><br>ALL BLOCK<br>IA SSME'S | BI-101<br><br>RSRM<br>74<br><br>ET-102<br>SLWT-7<br><br>ET<br>IMPACT<br>1:26:29<br>MET<br><br>LAT:<br>1.955<br><br>LONG:<br>127.3 W | 51.60<br>(3)<br><br>DIRECT<br>INSERTION | OI-27<br>(3)<br><br>POST OMS-2:<br>178.9 X 85.2<br>NM | CARGO:<br>35604 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>24733 LBS<br><br>DEPLOYED:<br>3371 LBS<br><br>NON-DEPLOYED:<br>20159 LBS<br><br>MIDDECK:<br>1262 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>934208 LBS<br>NON-DEPLOYED:<br>1462107 LBS<br>CARGO TOTAL:<br>3002132 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3783<br>FUEL BIAS: 720<br>FINAL TDDP: 733<br>RECON: 998<br><br>PAYLOADS:<br>PLB:<br><br>ISS 2A.2a<br>Spacehab DM<br>ICC, SEM-06, MARS<br>RMS, ODS<br><br>MIDDECK:<br>CPCG<br>PCG-BAG<br>BIOTUBE<br>AST<br><br>5 CRYO TK SETS<br>6 GH2 TANKS<br>RMS 55<br><br>RMS USED FOR<br>EVA SUPPORT | <b>Brief Mission Summary:</b> STS-101, 3rd mission to ISS, was initially designed to outfit the Russian Zvezda crew quarters. However, Zvezda's launch was delayed and the mission was changed to ISS maintenance and logistics support. Outfitting Zvezda would await STS-106 later in the year. A high priority of this flight was the replacement of four of six 800 amp Zarya batteries. Also, this was first flight of Shuttle "Glass Cockpit" upgrade.<br><br>KSC W/D: OPF 333, VAB 8, PAD 50 = 391 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline 8/5/99 as launch date on 10/5/98. Postponed to 10/14/99, then 12/2/99. TACAN scars removed for GPS scar then reinstalled TACAN.<br>- Postponed launch to 11/19/99 on 9/16/99. OV-103 wire inspections and repair.<br>- Postponed launch to 12/2/99 on 10/22/99. OV-103 wire inspections and repair.<br>- Postponed launch to 4/14/00 on 4/16/00. CDR training accident (ankle)<br>- Postponed launch to 4/24/00 on 4/16/00. OV-104 Rudder/Speed Brake PDU R&R from OV-102.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 3:17:17 PM EDT (115:20:17:17Z) 4/24/00 launch attempt while holding at T-9 minutes due to high RTLS crosswinds. Scrub was declared at approximately L-15 minutes, when RTLS crosswinds observed and forecast to exceed the 15-knot limit.<br>- Scrubbed 2:53:17 PM EDT (116:19:53:17Z) 4/25/00 launch attempt at L-1:35:00 by Launch Director when RTLS crosswinds persisted in 29-30 knots range and were forecast to exceed limit. RTLS Weather Scrub.<br>- Scrubbed 2:34:16 PM EDT (117:19:34:17Z) 4/26/00 launch attempt at 117:19:21Z (L-0H13M) while holding in T-9 min hold due to no TAL site. All three TAL sites were observed and forecast NO GO: ZZA for showers within 20 nm and forecast chance of broken 4000 feet. MRN for showers/thundershowers and forecast chance of broken 3000 feet. BEN was observed and forecast NO GO for crosswind violation. BEN wind swing from around 285 degrees to around 300 degrees after sundown did not materialize - crosswind forecast was steady state R11 and P16. The launch window opened 117:19:24:42Z and closed at 117:19:34:16Z and the PLT was 117:19:29:13Z for a launch window of 4M55S. TAL WX Scrub.<br>- Unable to get May 9 launch date due to GOES launch delays. Scheduled a May 18 launch at 6:32:00 AM EDT. At approximately L-36 hours, the Atlas III launch scrub due to high winds caused a slip to May 19.<br><br>LAUNCH WINDOW:<br>- Window opened at 140:10:09:29Z and closed at 140:10:16:14Z for a total window of 6M45S. Selected Preferred Launch Time (PLT) of 140:10:11:10Z for a launch window of 5M4S.<br><br>Continued... |



S99- 01417-- 1st flight MEDS cockpit

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N.                           | SRB RSRM<br>AND ET   | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|----------------------------------|---|--|--|--|-----------------------|--|-----|--|--|
| STS-101/<br>ISS 2A.2a  |         |                                  |   | Continued...<br><br><u>FLT DURATION:</u><br>9:20:09:09<br><br><u>S/T:</u><br>845:17:27:28<br><br><u>OV-104:</u><br>160:18:39:34<br><br><u>DISTANCE:</u><br>5,076,281 sm  |  |  |                       |  |     | Continued...<br><br><u>LAUNCH DELAYS:</u> None<br>- Launched on time at 140:10:11:10Z, 6:11:10 AM EDT on Friday, May 19, 2000.<br><br><u>TAL WX:</u><br>- Zaragoza (Prime and Selected), Moron, and Ben Guerir all forecast and observed GO.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard Set Plus: (1) PE Operational - High Q TRN/APR, (2) OMS Assist is 4000 lbs, (3) 52 NM MECO, and (4) Del psi<br><br><u>FLIGHT DURATION CHANGES:</u><br>- One-day extension. Extended flight one day to accomplish ISS tasks.<br><br><u>SHUTTLE NIGHT LAUNCH #23</u><br><br><u>SHUTTLE NIGHT LANDING #14</u><br>- Landed on KSC runway 15 at 150:06:20:19Z, 2:20:19 AM EDT on Monday, May 29, 2000.<br><br><u>FIRSTS/LASTS:</u><br>- First flight of glass cockpit (MEDS)<br>- First flight of OV-104 since STS-86 after OMDP. |  |
|    |         |                                  |   | <p>STS101-717-094 --- Inflight crew portrait on ISS Unity (Node 1). Rear (from left): Weber/MS, CDR Halsell, Williams/MS, &amp; PLT Horowitz. Front: Helms/MS, Usachev/MS (RSA), &amp; Voss/MS.</p>                                  |  |  |                       |  |     |  |  |
|   |         |                                  |   |   |  | <p><u>SIGNIFICANT ANOMALIES:</u></p> <ul style="list-style-type: none"><li>- Left OMS Engine Bipropellant Valve 2 indicates open.</li><li>- Left OMS Engine GN2 regulator pressure low during Post-Firing Purges.</li><li>- Ku-band radiating within RF Protect Box.</li><li>- PRSD Oxygen Tank 4 Heater temporarily failed.</li><li>- Collins TACAN BITE faults.</li><li>- Slump tile at wing leading edge with internal flow.</li><li>- APCU 1 converter B failure.</li><li>- MEDS MDU CRT 2 display screen came up blank.</li><li>- Speedbrake Ch 3 secondary Delta Pressure delayed response</li></ul> |                       |  |     |  |  |
| STS-101-390-025 (19-29 May 2000) --- Helms/MS performs battery maintenance below floor of Zarya.   |         |                                  |   | JSC2000-04279 - In JSC MCC: Flight Controllers huddle over I-load update for Day-of-Launch winds. From left: Larry Bourgeois/Space Ops, Steve Hawley/FCOD, FD Jeff Bantle; and Henry Cordova & Ed Gonzalez/Flight Design & Dynamics. |  |  |                       |  |     |  |  |
| <p><u>RENDZVOUS #47</u></p> <ul style="list-style-type: none"><li>- Rendezvous and dock with ISS at PMA2, Node 1 Forward Port.</li></ul> |         |                                  |   |  |  |  |                       |  |     |  |  |

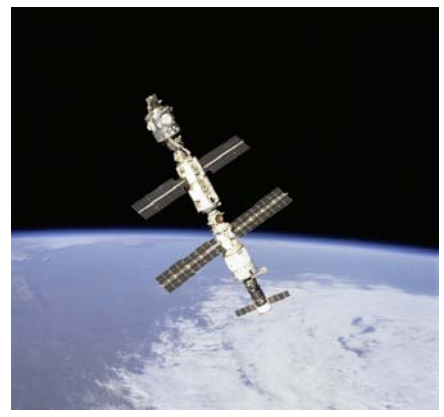


# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-125 - STS-106/2A.2b




| FLT NO.                      | ORBITER                     | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET   | ORBIT INC HA/HP  | FSW       | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|------------------------------|-----------------------------|--|--|---|---|---|--|-----------|---|---|
| STS-106/ ISS 2A.2b           | OV-104 (Flight 22) Atlantis | CDR: Terrence W. Wilcott (Flt 4 - STS-68, STS-79, STS-89) P584/R183/V130/M160<br><br>OMS PODS: LPO3-26 RPO4-22 FRC4-22<br><br>PLT: Scott D. Altman (Flt 2 - STS-90) P585/R237/V161/M207<br><br>M/S 1/EV1: Edward T. Lu (Flt 2 - STS-84) P586/R222/V162/M194<br><br>M/S 2: Richard A. Mastracchio P587/R257/M224<br><br>M/S 3: Daniel C. Burbank P588/R258/M225<br><br>M/S 4/EV2: Yuri Malenchenko (Russia) P589/R259/M226<br><br>M/S 5: Boris Morukov (Russia) P590/R260/M227<br><br>SS EVA #50 EMU/TETHERED EVA #43 SCHEDULED EVA #44 DURATION 6:14 | KSC PAD 39B 252:12:45:47Z 8:45:47 AM EDT (P) 8:45:47 AM EDT (A) Friday 22 9/8/00 (10)<br><br>LAUNCH WINDOW: 3:54 USING PLT (IN-PLANE TIME)<br><br>EOM PLS: KSC TAL: ZZA TAL WX: MRN, BEN<br><br>SELECTED: RTLS: KSC 33 N/N TAL: ZZA 30 N/N AOA: NOR 17N/SFD PLS: EDW 22 N/N<br><br>TDEL: 0.09 -0.348/-0.31<br><br>MAX Q NAV: 710 712<br><br>SRB STG: 2:03.4 2:02<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA): 2:28 2:23<br><br>NEG RETURN: 3:52 3:52<br><br>PTA (U/S 267): 4:39 4:38<br><br>PTM (U/S 267): 5:47 5:46<br><br>SE TAL (ZZA): 5:52 6:05<br><br>SE PTM (U/S 827) 6:49 6:48<br><br>MECO CMD: 8:24.3 8:25.6 | KSC 15 (KSC 52) 264:07:56:44Z 3:56:44 AM EDT<br><br>Wednesday 11 9/20/00 (10)<br><br>DEORBIT BURN: 264:06:50:07 Z<br><br>XRANGE: 203 NM<br><br>ORBIT DIR: AL 25<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 2951 FT 264:07:56:44Z<br><br>VEL: 187 KGS 186 KEAS<br><br>HDOT: -2.5 FPS<br><br>TD NORM 205: 1643 FT<br><br>DRAG CHUTE DEPLOY: 180 KEAS 264:07:56:46Z<br><br>NLGTD: 5485 FT 264:07:56:52Z<br><br>VEL: 153 KGS 153 KEAS<br><br>HDOT: -6.3 FPS<br><br>BRK INIT: 71 KGS<br><br>DRAG CHUTE JETTISON: 56 KGS 264:07:57:23Z<br><br>BRK DECEL FPS <sup>2</sup> : AVE 2.7 PK 4.8<br><br>WHEELS STOP: 264:07:58:02Z 12078 FT<br><br>ROLLOUT: 9127 FT 78 SEC<br><br>WINDS: 1306P09 SS: 5H 2L PK: 8H 4L<br><br>DENS ALT: 1761 FT | 104/104/ 109%<br><br>PREDICTED: 100/104.5/ 104.5/72 104.5<br><br>ACTUAL: 100/104.5/ 98/72/104.5<br><br>1 = 2052 (2)<br>2 = 2044 (4)<br>3 = 2047 (4)<br><br>ALL BLOCK IIA SSME'S | BI-102<br><br>RSRM 75<br><br>ET-103 SLWT-8<br><br>ET IMPACT 1:26:12 MET<br><br>LAT: 2.46°S<br><br>LONG: 128.1°W | 51.60 (4)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 176.4 X 85.0 NM | OI-27 (4) | CARGO: 34991 LBS<br><br>PAYLOAD CHARGEABLE: 23967 LBS<br><br>DEPLOYED: 5399 LBS<br><br>NON-DEPLOYED: 17935 LBS<br><br>MIDDECK: 1172 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 939607 LBS NON-DEPLOYED: 1481214 LBS CARGO TOTAL: 3037123 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3274 FUEL BIAS: 818 FINAL TDDP: 1940 RECON: 317<br><br>PAYLOADS: PLB: ISS-2A.2b Spacehab/DM ICC (SHOSS Box, SOAR) GAS (2) RMS, ODS<br><br>MIDDECK: CGBA DTO EMU H/W EVA Tools<br><br>5 CRYO TK SETS 6 GN2 TKS RMS 56<br><br>RMS USED FOR EVA SUPPORT | <b>Brief Mission Summary:</b> The goal of the STS-106 mission, 4 <sup>th</sup> mission to ISS, was to prepare the Zvezda Service Module for the arrival, later in the year, of the first residents, Expedition 1 crew, to start a permanent human presence on the ISS outpost.<br><br>KSC W/D: OPF 66, VAB 5, PAD 22 = 93 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 8/19/00 on 2/17/00.<br>- Postponed launch to 9/8/00 on 5/17/00.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH WINDOW:<br>- Launch window opened at 252:12:42:01Z and closed at 252:12:49:41Z for a total window of 7M40S. Preferred Launch Time (PLT) (In-Plane Time) was 252:12:45:47Z, 8:45:47 AM EDT, resulting in a launch window of 3M54S.<br><br>LAUNCH DELAYS: None<br>- Launch occurred on time at 252:12:45:47Z, 8:45:47 AM EDT on Friday, September 8, 2000.<br><br>TAL WX:<br>- Zaragoza (Prime and Selected) and Moron (2-engine TAL) were both forecast and observed GO, Ben Guerir was forecast and observed NO GO for crosswinds. KSC RTLS forecast and observed precipitation within 20 nm; however, was GO based on Flight Rule A2.1.1-6C4e, f, and g. LANDING SITE WEATHER CRITERIA [HC], "2-nm vertical clearance from the top of that shower and a 10-nm lateral clearance must be maintained along the approach paths..."<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set plus: (1) PE Operational High Q SUM/SEP, (2) OMS assist is 4000 lbs, (3) 52 NM MECO, and (4) Del Psi<br><br>FLIGHT DURATION CHANGES:<br>- One-day extension. Extended Flight one day to accomplish additional ISS tasks.<br><br>SHUTTLE NIGHT LANDING #15:<br>- Landed on KSC runway 15, orbit 185 at 264:07:56:44Z, 3:56:44 AM EDT on Wednesday, September 20, 2000.<br><br>Continued... |
| SEQ FLT #99                  |                             |  |  |   |   |   |  |           |   |   |
| KSC-99                       |                             |  |  |   |   |   |  |           |   |   |
| PAD 39B-43                   |                             |  |  |   |   |   |  |           |   |   |
| MLP-2                        |                             |  |  |   |   |   |  |           |   |   |
| FOURTH SHUTTLE FLIGHT TO ISS |                             |  |  |   |   |   |  |           |   |   |
| SPACEHAB #15                 |                             |  |  |   |   |   |  |           |   |   |

STS106-712-028 -- Atlantis crew found a much larger ISS since STS-101 departure with the addition of the Russian Zvezda and a docked Progress resupply ship.





# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.                                 | SRB RSRM AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|--|---------|--|---|--|--|-----------------|-------|--|-----|--|---|--|
| STS-106/ ISS 2A.2b   |         | Continued...<br><br>MCC WHITE FCR (29)<br><br>FLIGHT DIRECTORS:<br>A/E - N. W. Hale<br>LD/O1 - P. L. Engelauf<br>O2 - P. F. Dye<br>O3 - K. B. Beck<br>O4 - W. D.Reeves<br><br>ISS LD/O1 - M. J. Ferring<br>ISS O2 - J. M. Hanley<br>ISS PLNG - R. E. LaBrode<br>MOD - J. W. Bantle | Continued...<br><br>VI:<br>25926 25928<br><br>OMS-2:<br>44:00 44:00<br>81 FPS 81 FPS<br>00:52 00:54 | Continued...<br><br>FLT DURATION:<br>11:19:10:57<br><br>S/T:<br>857:12:38:25<br><br>QV-102:<br>172:13:50:31<br><br>DISTANCE:<br>4,919,243 sm |  |                 |       |  |     | Continued...                           |   |  |
| STS106-349-002 (8-20 September 2000) --- This unique picture captures the cabin of Atlantis, the RMS arm, and part of the ISS.   |         |   |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
|    |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left, Burbank/MS, Lu/MS &amp; Mastracchio/MS. &amp; Morukov/MS (RSA).</p> |         |  |   |  |  |                 |       |  |     |  |   |  |
| <p>STS106-373-019 --- Inflight crew portrait on ISS. Front, from the left, Malenchenko/MS (RSA), CDR Wilcutt, PLT Altman. Back, from left</p>  |         |  |   |  |  |                 |       |  |     |  |   |  |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER  | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET                             | ORBIT<br>INC<br>HA/HP  | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|--|--|---|--|---|--|--|--------------|--|---|
| STS-92/<br>ISS 3A<br><br>SEQ<br>FLT # 100<br><br>KSC-100<br><br>PAD<br>39A-57<br><br>MLP-3<br><br>FIFTH<br>SHUTTLE<br>FLIGHT TO<br>ISS | OV-103<br>(Flight 8<br>(Discovery)<br><br>OMS PODS:<br>LPO1-31<br>RPO3-29<br>FRC3-28 | CDR:<br>Brian Duffy<br>(Flt 4 - STS-45, STS-57,<br>STS-72)<br>P591/R142/V94/M126<br><br>PLT:<br>Pamela A. Melroy<br>P592/R261/F34<br><br>M/S 1/EV1:<br>Leroy Chiao<br>(Flt 3 - STS-65, STS-72)<br>P593/R179/V125/M157<br><br>M/S 2/EV2:<br>William S. McArthur<br>(Flt 3 - STS-58, STS-74)<br>P594/R172/V124/M150<br><br>M/S 3/EV3:<br>Peter J. K. (Jeff) Wisoff<br>(Flt 4 - STS-57, STS-68,<br>STS-81)<br>P595/R166/V110/M145<br><br>M/S 4/EV4:<br>Michael E. Lopez-Alegria<br>(Flt 2 - STS-73)<br>P596/R202/V163/M175<br><br>M/S 5:<br>Koichi Wakata<br>(Japan)<br>(Flt 2 - STS-72)<br>P597/R208/V164/M181<br><br>SS EVA #51<br>EMU/TETHERED<br>EVA #44<br>SCHEDULED EVA #45<br>DURATION 6:28<br><br>SS EVA #52<br>EMU/TETHERED<br>EVA #45<br>SCHEDULED EVA #46<br>DURATION 7:08<br><br>Continued... | KSC 39A<br>285:23:17:00 Z<br>6:17:00 PM EST<br>6:17:00 PM EST<br>Wednesday 10<br>10/11/00 (10)<br><br>LAUNCH WINDOW:<br>4:12 USING PLT<br>(IN-PLANE TIME)<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 33 N/N<br>TAL: BEN 36 C/N<br>AOA: KSC 33 N/N<br>PLS: EDW C/N<br><br>TDEL:<br>0.00 -0.04<br><br>MAX Q NAV:<br>752 748<br><br>SRB STG:<br>2:02.6 2:02<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>2:25 2:27<br><br>NEG RETURN:<br>3:57 3:57<br><br>PTA (U/S 282):<br>4:40 4:41<br><br>PTM (U/S 282):<br>5:56 6:05<br><br>SE ZZA:<br>6:02 6:02<br><br>SE PTM:<br>6:48 6:55<br><br>MECO CMD:<br>8:25.3 8:25.6<br><br>Continued... | EDW 22, CONC<br>EDW 46, CONC 27<br>298:20:59:42 Z<br>12:59:42 PM PST<br><br>Tuesday 16<br>10/24/00 (8)<br><br>DEORBIT BURN:<br>298:19:52:00Z<br><br>X RANGE: 200 NM<br><br>ORBIT DIR: AL 26<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2656 FT<br>298:20:59:42Z<br>VEL: 205 KGS<br>201 KEAS<br>HDOT: -2.9 FPS<br><br>TD NORM 195:<br>3287 FT<br><br>DRAG CHUTE<br>DEPLOY: 188 KEAS<br>298:20:59:46Z<br><br>NLGTD: 6504 FT<br>298:20:59:54Z<br>VEL: 144 KGS<br>152 KEAS<br>HDOT: -6.7 FPS<br><br>BRK INIT: 67 KGS<br><br>DRAG CHUTE<br>JETTISON: 55 KGS<br>298:21:00:21Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 3.5 PK 5.3<br><br>WHEELS STOP:<br>11746 FT<br><br>ROLLOUT:<br>9090 FT<br>67 SEC<br><br>WINDS:<br>2009P16 KTS<br>SS: 8H 4L<br>PK: 15H 7L<br><br>DENS ALT:<br>3743 FT<br><br>Continued... | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>1 = 2045 (3)<br>2 = 2053 (2)<br>3 = 2048 (2)<br><br>ALL BLOCK<br>IIA ENGINES | BI-104<br><br>RSRM<br>76<br><br>ET-104<br><br>SLWT 9 | 51.60<br>(5)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>175.1 x 85.4<br>NM<br><br>TI BURN:<br>1/14:52 MET<br><br>ORBIT:<br>206.2 X 200.1<br>NM | OI-27<br>(5) | CARGO:<br>35250 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>28009 LBS<br><br>DEPLOYED:<br>21998 LBS<br><br>NON-DEPLOYED:<br>4678 LBS<br><br>MIDDECK:<br>1333 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>961605 LBS<br>NON-DEPLOYED:<br>1487225 LBS<br>CARGO TOTAL:<br>3072373 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3274<br>FUEL BIAS: 818<br>FINAL TDDP: 1532<br>RECON: 2330<br><br>PAYLOADS:<br>PLB:<br>ISS-3A<br>ISS Z1 TRUSS<br>CMG'S<br>KU/S-BAND<br>PMA-3/SLP<br>ICBC30<br>RMS, ODS<br><br>MIDDECK:<br>DTO<br>EMU H/W<br>EVA TOOLS<br><br>5 CRYO TK SETS<br>6 GH2 TKS<br><br>Continued... | <b>Brief Mission Summary:</b> STS-92, the 5 <sup>th</sup> mission to ISS, delivered the first framework structure, Z1 truss, to house communications and motion control equipment; and delivered the third Pressurized Mating Adapter docking station. This was the 100 <sup>th</sup> mission of America's Space Shuttle.<br><br>KSC W/D: OPF 197, VAB 10, PAD 21 = 238 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 7/23/98 on 3/13/97<br>- Postponed launch to 1/14/99 on 5/27/97. ISS Flight Delays<br>- Postponed launch to 6/17/99 on 6/4/98. ISS Flight Delays<br>- Postponed launch to 12/2/99 on 2/4/99. ISS Flight Delays<br>- Postponed launch to 6/14/00, then to 10/28/99, to 9/21/00, to 10/5/00 due to ISS Service Module Delays<br><br>LAUNCH SCRUBS:<br>- Scrubbed launch on EST date of 10/5/00 at ET Tanking MMT due to Orb/ET Attach Bolt Protrusion. Launch was scheduled for 9:38:46 PM EST (280:01:38:46Z GMT date of 10/6/00). A Review of STS-106 ET 35 mm film revealed RH Orbiter/ET attach bolt protruding several inches causing concern for bolt contact with Orbiter during sep sequence with potential for a tip load and subsequent ET/Orbiter contact. Film review of additional flights and loads analyses needed to clear STS-92 launch. During recycle, POGO valve #2 did not get an open indication when valve was cycled open. Replaced POGO valve with launch date of 10/9/00. Completed film review and analyses which cleared protruding bolt concern (within pogo valve replacement time.). Technical Scrub. Reset launch for 10/9/00 EST, 10/10/00 GMT.<br>- Scrubbed launch on EST date of 10/9/00 at ET Tanking MMT due to wind gusts greater than 42 knots holding up extension of the GO <sub>2</sub> Vent Arm. Ran out of time to complete work in time for launch at 8:05:17 PM EST, 284:00:05:17Z GMT date of 10/10/00 (3.5 hours work after arm extension before tanking could start at L-8.5 hour). Weather Scrub. Reset launch for 10/10/00 at 7:39:36 EST.<br>- Scrubbed 10/10/00 launch at L-1H07M due to a concern for debris damage by a wayward pip pin and tether seen on the LO <sub>2</sub> feedline foam inboard support bracket. Pip pin was discovered during ice/debris team walkdown. (Launch had been scheduled for 7:39:36 EST. Technical scrub. Reset launch for 10/11/00.<br><br>LAUNCH WINDOW:<br>- Total launch window was 7M58S. Window opened at 285:23:13:14Z and closed at 285:23:21:12Z. Selected Preferred Launch Time (PLT) of 285:23:17:00Z (in-plane time) giving a launch window of 4M12S.<br><br>LAUNCH DELAYS: None<br>- Launched on time at 285:23:17:00Z, 6:17:00 PM EST on Wednesday, October 11, 2000.<br><br>Continued... |

STS092-S-022 [EC00-0311-3]  
(24 OCTOBER 2000) ---  
Successful landing at EAFB of  
the 100<sup>th</sup> Shuttle mission – "Still  
young at 100", PAO.





# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-128 - STS-92/3A

| FLT NO.                               | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---------------------------------------|---------|---|---|--|---|--------------------------|--------------------|--|-----|---|---|
| STS-92/<br>ISS 3A<br><br>Continued... |         | Continued...<br><br>SS EVA #53<br>EMU/TETHERED<br>EVA #46<br>SCHEDULED EVA #47<br>DURATION 6:48<br><br>SS EVA #54<br>EMU/TETHERED<br>EVA #47<br>SCHEDULED EVA #48<br>DURATION 6:56<br><br>MCC WHITE FCR (30)<br><br><u>FLIGHT DIRECTORS:</u><br>Asc - N. W. Hale<br>Ent - L. E. Cain<br>LD/O3 - C. W. Shaw<br>O1 - R. E. Castle<br>O2 - J. P. Shannon<br>O4 - B. P. Austin<br><br>ISS LD/O1 - S. P. Davis<br>ISS O2 - M. A. Kirasich<br>ISS PIng/O3 - R. E. LaBrode<br>MOD - J. M. Heflin | Continued...<br><br>VI:<br>25931 25928<br><br>OMS-2:<br>43.30 43.33<br>82.4 FPS 82.1 FPS<br>00:54 00:54 | Continued...<br><br><u>FLT DURATION:</u><br>12:21:42:42<br><br><u>S/T:</u><br>870:10:21:07<br><br><u>OV-103:</u><br>217:05:38:18<br><br><u>DISTANCE:</u><br>5,331,301 sm |   |                          |                    |  |     | Continued...<br><br>RMS 57<br>(S.N. 301)<br><br>RMS USED FOR<br>OSVS checkout,<br>Z1 truss grapple<br>and install on ISS<br>and EVA support<br>PMA3/SLP on Z1 | Continued...<br><br><u>TAL WX:</u><br>- Zaragoza (prime) forecast and observed NO GO for rain, Moron forecast and observed NO GO for violent storms, Ben Guerir (selected) Qbar 353 vs. 350 limit at 1100 feet cleared by L-10 minute balloon. NOTE: PTA set on AOA FOR KSC even though forecast showed chance of rain and chance 4000 ft broken and peak winds of 13 knots. EDW and NOR down for AOA/PLS, FD2 PLS would have resulted in additional 10 second TAL exposure.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard Set Plus: (1) PE Operational High Q TRN/OCT, (2) OMS assist is 4000 lbs, (3) 52 nm MECO, and (4) Del Psi.<br>- Note: OMS Assist Time reduced from 102 seconds to 41 seconds with DOLILU uplink (2400 lbs more OMS to orbit).<br>- Inert weight adjustment is 199 lbs; was -200 lbs.<br><br><u>SHUTTLE NIGHT LAUNCH #24</u><br><br><u>FLIGHT DURATION CHANGES:</u><br>- Total Flight duration extension was 2 days plus 3 orbits.<br>- EDW was not called up for NEOM.<br>- Did not close PLBD's. Waved-off landing at KSC on orbits 170 and 171 due to sustained high SLF crosswinds. EOM+1.<br>- Waved-off landing at KSC on orbits 186 and 187 (Did not close PLBD's or crew in suits) due to high crosswinds.<br>- Retargeted to EDW on orbit 187, then waved-off due to broken ceiling and showers within 30 nm.<br>- Targeted EDW on orbit 188, closed PLBD's, and put crew in suits. Waved-off landing at EDW on orbit 188 at Tig-16 minutes due to forecast and observed showers and rain within 30 nm.<br>- Waved-off landing at EDW on orbit 189 at Tig-1 hour for showers and rain within 30 nm. NOEM+2. Activated NOR for EOM+2.<br>- Did not attempt to land at KSC on orbits 201 and 202 due to forecast and observed high crosswinds, low ceiling, and rain within 30 nm. Landed at EDW runway 22 on orbit 203 at 298:20:59:42Z, 12:59:42 PM PST, Tuesday, October 24, 2000.<br><br><u>EVENTS:</u><br>- Ring capture at 287:17:45:10Z, 1:18:28:10 MET<br>- Docked at PMA2 Node 1 Forward Port at 287:17:57:55Z<br>- Z1 Truss grapple at 288:15:57:14Z, Z1 release 288:19:05:30Z<br>- EVA 1 Start at 289:14:26Z, duration 6H28M.<br>- PMA grapple at 290:15:43:30Z, PMA release at 290:17:59:35Z<br>- EVA 2 Start at 290:14:13Z, duration 7H08M.<br>- ISS Reboost maneuver #1 Start at 290:21:03:00Z, 4:21:46:00 MET, Delta-V was 6 fps, 1.5 nm, 208 by 202 nm.<br>- EVA 3 Start at 291:14:29Z, duration 6H48M.<br>- ISS Reboost maneuver #2 Start at 291:22:45:59Z, 5:23:28:59 MET, 5.8 fps, 1.5 nm, 211 by 202 nm.<br>- EVA 4 Start at 292:15:00Z, duration 6H56M.<br>- ISS Reboost maneuver #3 Start at 292:22:23:32Z, 6:23:06:32 MET, 5.6 fps, 1.5 nm, 214 by 202 nm.<br><br>Continued... |



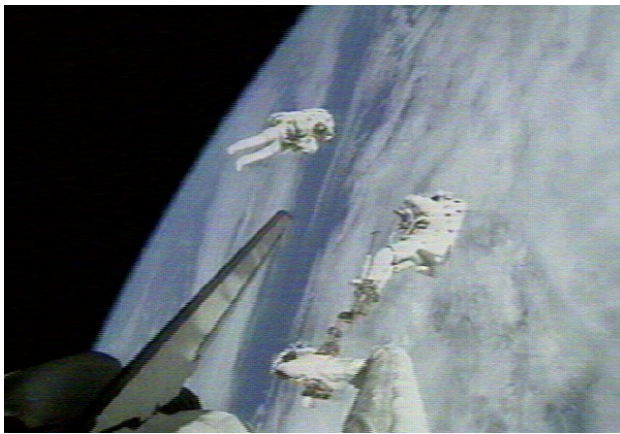
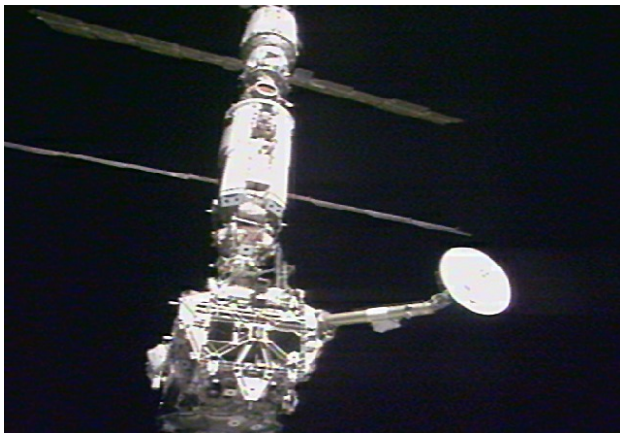

STS092-342-011 --- In-flight crew portrait. Front, from the left: Wisoff/MS, Wakata/MS (NASDA), CDR Duffy, & McArthur/MS. Rear, from the left: PLT Melroy, Chiao/MS, Lopez-Alegria/MS.







# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-129 - STS-92/3A

| FLT NO.       | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS               | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---------------|---------|--------------------------------------|---|--|--|--------------------------|-------|--|-----|--|--|
| STS-92/ISS 3A |         |                                      |   |  |  |                          |       |  |     |  | Continued...<br><br><u>EVENTS: (Continued)</u><br>- Undocked at 294:15:08:21Z, 8:15:51:21 MET<br>- Total transfers to ISS - 21998 lbs (includes Z1=18351 and PMA3=2549 lbs).<br>- Delivered Z1 Truss. Mated Z1 to Node 1 zenith port. Installed CMG jumper. Z1 umbilicals connected and powered. Delivered PMA3 and berthed to Node 1 Nadir Port, umbilicals connected. SGANT deployed. Relocated IAPFR and Z1 FRGF. Installed two DDCU's and ETSD on Z1.<br>- STS-92/3A ISS Visitor Time 6:21:10:26.<br>- ISS Visitor time 6D21H10M26S<br><br><u>RENDEZVOUS #49:</u><br>- Rendezvous and dock with ISS at PMA2 Node 1 Forward Port<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Airlock Depress Valve Cap came loose from tether and was lost<br>- FES Primary B shutdown in Full-Up mode.<br>- Cabin Payload 3 Bus loss, which powered OIU 1, OSVS, ODS C/L Camera.<br>- EMU Middeck Battery Charger ready indication failure<br>- APFR/IAPFR interference with flush side-mounted WIF's<br>- Modular Mini Workstation anomaly<br>- Pistol Grip tool chatter<br>- Difficulty mating PMA 3 P607 to Node J609<br>- Ku-band lost forward link<br>- WSB 2 failed to cool<br>- ODS C/L Camera misalignment<br>- WSB 2 GN <sub>2</sub> Relief Valve high cracking P and low reseal P.<br>- DSC OM2 Card 22 failure<br>- WSB 3 Steam Vent Heater erratic |
| Continued...  |         |                                      |   |   | LEFT: JSC2000-E-26675 --- Astronauts Peter J.K. (Jeff) Wisoff and Michael Lopez-Alegria participate in final of four STS-92 space walks, including a run with SAFER backpack." |                          |       |  |     |  |  |
|               |         |                                      |   |  | BELOW: JSC2000-06403 --- Wayne Hale (front center), Ascent Flight Director for the STS-92 mission, poses with the 50-odd flight controllers who supported his shift.           |                          |       |  |     |  |  |
|               |         |                                      |   |  | JSC2000-E-26636--- ISS after installation of Z1 Truss. From the top, elements are the Zvezda, the FGB or Zarya, Node 1 or Unity, and Z1.                                       |                          |       |  |     |  |  |
|               |         |                                      |   |  |   |                          |       |  |     |  |  |

# SPACE SHUTTLE MISSIONS SUMMARY




| FLT NO.  | ORBITER  | CREW (5)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT   |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|--|--|--|--|---|---|---|--|--|---|
| STS-97/ISS 4A<br><br>SEQ FLT #101<br><br>KSC-101<br><br>PAD 39B-44<br><br>MLP- 1<br><br>SIXTH SHUTTLE FLIGHT TO ISS  | OV-105 (Flight 15)<br><br>Endeavour<br><br>OMS PODS: LPO4-22 RPO1-29 FRC5-15 | CDR: Brent W. Jett (Flt 3 - STS-72, STS-81) P598/R206/V132/M179<br><br>PLT: Michael J. Bloomfield (Flt 2 - STS-86) P599/R227/V165/M198<br><br>M/S 1/EV1: Joseph R. Tanner (Flt 3 - STS-66, STS-82) P600/R185/V136/M162<br><br>M/S 2: Marc Garneau (Canada) (Flt 3 - STS-41-G, STS-77) P601/R47/V128/M44<br><br>M/S 3/EV2: Carlos I. Noriega (Flt 2 - STS-84) P602/R221/V166/M193<br><br>SS EVA #55 EMU/TETHERED EVA #48 SCHEDULED EVA #49 DURATION 7:33:23<br><br>SS EVA #56 EMU/TETHERED EVA #49 SCHEDULED EVA #50 DURATION 6:37:19<br><br>SS EVA #57 EMU/TETHERED EVA #50 SCHEDULED EVA #51 DURATION 5:09:49 | KSC 39B<br>336:03:06:01 Z<br>10:06:01 PM EST (P)<br>10:06:01 PM EST (A)<br>Thursday 30<br>11/30/00 (13)<br><br>LAUNCH WINDOW: 4M01S USING PLT (IN-PLANE TIME)<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED: RTLS: KSC 33 N/N<br>TAL: ZZA 30 SF/N<br>AOA: KSC 33 N/N<br>PLS: EDW 4 N/N<br><br>TDEL: 0.11 -0.048/-0.01<br><br>MAX Q NAV: 758 753<br><br>SRB STG: 2:03.5 2:03.0<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA): 2:43 2:40<br><br>NEG RETURN: 3:51 3:54<br><br>PTA (U/S 265): 4:54 4:54<br><br>PTM (U/S 265): 5:54 5:53<br><br>SE TAL (ZZA) 5:55 5:55<br><br>SE PTM 6:55 6:58<br><br>MECO CMD: 8:24.3 8:25.9<br><br>Continued... | KSC 15 (KSC 53)<br>346:23:03:23Z<br>6:03:23 PM EST<br><br>Monday 19<br>12/11/00 (12)<br><br>DEORBIT BURN: 346:21:57:31Z<br><br>X RANGE: 20 NM<br>ORBIT DIR: AR 8<br>AIM PT: CLOSE IN<br>MLGTD: 2360 FT<br>346:23:03:23Z<br>VEL: 196 KGS<br>199 KEAS<br>HDOT: -3.5 FPS<br><br>TD NORM 195: 2783 FT<br><br>NLGTD: 5839 FT<br>346:23:03:35Z<br>VEL: 138 KGS<br>144 KEAS<br>HDOT: -6.5 FPS<br><br>DRAG CHUTE DEPLOY: 189 KEAS<br>346:23:03:27Z<br><br>BRK INIT: 88 KGS<br><br>DRAG CHUTE JETTISON: 70 KGS<br>346:23:03:53Z<br><br>BRK DECEL FPS/S: AVE 4.6 PK 6.7<br><br>WHEELS STOP: 346:23:04:20Z<br>10340 FT<br><br>ROLLOUT: 7980 FT<br>57 SEC<br><br>WINDS: 6H 2L<br>OFFICIAL: 1406P09<br>SS: 6H 1L<br>PK: 9H 2L<br><br>Continued... | 104/104/109%<br><br>PREDICTED: 100/104.5/104.5/72/104.5<br><br>ACTUAL: 100/104.5/104.5/72/104.5<br><br>1 = 2054 (2)<br>2 = 2043 (5)<br>3 = 2049 (4)<br><br>ALL BLOCK IIA ENGINES | BI-103<br><br>RSRM 72<br><br>ET-105<br><br>SLWT 10<br><br>ET IMPACT 1:26:32 MET<br><br>LAT: 1.54°S<br><br>LONG: 127.4°W | 51.60 (6)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 175.1 X 106.2 NM<br><br>TI BURN: 1:14:26:43 MET<br><br>ORBIT: 199.6 X 204 NM<br><br>MC-4: 1:15:50:55Z<br><br>ORBIT: 205.5 X 201.3 NM | 01-27 (6)<br><br>CARGO: 42804 LBS<br><br>PAYLOAD CHARGEABLE: 37486 LBS<br><br>DEPLOYED: 36213 LBS<br><br>NON-DEPLOYED: 719 LBS<br><br>MIDDECK: 1021 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 997818 LBS<br>NON-DEPLOYED: 1488965 LBS<br>CARGO TOTAL: 3115177 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3274<br>FUEL BIAS: 818<br>FINAL TDDP: 1920<br>RECON: 2032<br><br>PAYLOADS: PLB: ISS-4A<br>PV module P6<br>ICBC3D<br>RMS, ODS<br><br>MIDDECK: HEDS tech demo<br>EMU H/W,<br>EVA Tools<br><br>5 CRYO TK SETS<br>5 GN2 Tanks<br>RMS 58<br><br>RMS USED FOR P6 TRUSS AND EVA SUPPORT | <b>Brief Mission Summary:</b> The STS-97/4A mission, 6 <sup>th</sup> mission to ISS, helped "Station spread its wings". The 17-ton P6 Integrated Truss Segment (the 1 <sup>st</sup> of four such sets) was delivered and installed on ISS. With the deployment of its 240-foot solar arrays the ISS could now provide more electrical power than on any spacecraft before it. This was also the 1 <sup>st</sup> Shuttle to visit an inhabited ISS.<br><br>KSC W/D: OPF 203, VAB 5, PAD 26 = 234 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 4/8/99 on 11/6/97<br>- Postponed launch to 8/5/99, 2/3/00, 3/23/00, 7/20/00, 12/2/00, and then 11/30/00 EST (12/1/00 GMT date). The primary cause for postponements was Service Module late delivery to ISS.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH WINDOW:<br>- Total launch window was 7M45S. Window opened at 336:03:02:17Z and closed at 336:03:10:02Z. Selected Preferred Launch Time (PLT) of 336:03:06:01Z (In-plane time) resulting in a launch window of 4M01S.<br><br>LAUNCH DELAYS: None<br>- Launched on time at 336:03:06:01 GMT on December 1, 2000 (at 10:06:01 PM EST on Thursday, November 30, 2000).<br>- Note: During the count, a loose Firex line bracket/clamp was discovered on OAA, which was rolled back to allow access and removal using a 180 foot condor crane. No impact to launch.<br><br>TAL WX:<br>- Zaragoza (prime and selected) was forecast and observed GO, Moron was forecast and observed NO GO due to low ceiling, and Ben Guerir (2-engine TAL call) was forecast and observed GO.<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set plus: (1) PE Operational High Q WIN/DEC, (2) OMS assist is 4000 lbs, (3) 52 NM MECO, (4) No roll to heads up, and (5) Del Psi<br><br>FLIGHT DURATION CHANGES: None<br>- Landed at KSC runway 15 on orbit 170. MLGTD at 346:23:03:23Z (10:19:57:22 MET) on Monday, December 11, 2000.<br><br>SHUTTLE NIGHT LAUNCH #25<br><br>SHUTTLE NIGHT LANDING #16<br>- Landed on KSC runway 15 on orbit 170 at 346:23:03:23Z, 6:03:23 PM EST on Monday, December 11, 2000.<br><br>Continued... |  |   |
| <div></div> |  |  |  |  |  |   |   |   |  |  |   |
| Continued...   |  |  |  |  |  |   |   |   |  |  |   |



S97-E-5031 (5 December 2000) ---  
Tanner/MS during EVA & newly deployed  
ISS solar array panel.






# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (5)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES                               | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.                          | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|--|---------|---|--|--|--|------------------------|------------------------|--|-----|---|---|--|
| STS-97/ ISS 4A   |         | Continued...<br><br>MCC WHITE FCR (31)<br><br><u>FLIGHT DIRECTORS:</u><br>Asc - N. W. Hale<br>Ent - L. E. Cain<br>LD/O1 - W. D. Reeves<br>O2 - P. L. Engelauf<br>PLNG - K. B. Beck<br><br>ISS LD/O2 - J. M. Hanley<br>ISS O1 - J. M. Curry<br>ISS PLNG - P. S. Hill<br>MOD - J. W. Bantle | Continued...<br><br>VI:<br>25930 25928<br><br>OMS-2:<br>43:10.6 43:14.6<br>121 FPS 119 FPS | Continued...<br><br>DENS ALT:<br>1068 FT<br><br>FLT DURATION:<br>10:19:57:22<br><br>S/T:<br>881:06:18:29<br><br>OV-105:<br>155:05:44:02<br><br>DISTANCE:<br>4,476,164 sm |  |                        |                        |  |     | Continued...                                  |   |  |
| <p><b>EVENTS:</b></p> <ul style="list-style-type: none"><li>- Ring capture at 337:19:59:35Z</li><li>- Docked with ISS PMA3 Node 1 Nadir Port at 337:20:11:47Z (1:17:03:59 MET)</li><li>- RMS grapple of P6 Truss from PLB at 337:22:16:57Z, 1:19:19:59 MET. P6 moved to overnight park position and grapple released at 338:20:17:25Z, 2:17:11 MET.</li><li>- Hatch between orbiter and PMA3 was opened at 338:00:22:01Z, 1:21:16 MET</li><li>- EVA 1 Start at 338:18:34:46Z, 2:15:29:45 MET and End at 2:23:02:06 MET, duration 7:33:23. 2B Solar Array wing deployed, but had tensioning problem.</li><li>- RMS used to deploy P6 Truss to Z1 Truss. P6 Truss 4B SAW deployed.</li><li>- EVA 2 Start at 340:17:20:52Z, 4:14:14:51 MET and End 4:20:52:10 MET, duration 6:37:19</li><li>- EVA 3 Start at 342:16:12:13Z, 6:13:06:12 MET and End 6:18:16:01 MET, duration 5:09:49. EVA crew successfully tensioned SAW 2B.</li><li>- Undocked at 344:19:13:00Z (8:16:06:59 MET)</li><li>- Total Transfers from orbiter to ISS 1457 lbs, includes 773 lbs hardware and 7 CWC's with 684 lbs H<sub>2</sub>O. Transfers from ISS to orbiter 227 lbs.</li><li>- ISS Visitor time 6:23:01:13 (docking to undocking).</li><li>- Delivered and mated P6 Truss to Z1. Deployed and activated 2B and 4B Solar Array wings. Deployed and activated PMV radiator, EETCS aft radiator. Relocated S-band Antenna Support assembly. ISS EPS reconfigured to power U.S. and Russian Segments. FPP assembled and tested.</li></ul> <p><b>RENDEZVOUS #50:</b></p> <ul style="list-style-type: none"><li>- Rendezvous and dock with ISS at PMA2 Node 1 Nadir Port.</li></ul> <p><b>SIGNIFICANT ANOMALIES:</b></p> <ul style="list-style-type: none"><li>- Waste water quantity sensor dropouts</li><li>- Crew could not remove Cabin Temp Controller Actuator Pip Pin</li><li>- APCU 1 converters shutdown and APCU 2 tripped off.</li><li>- During EVA 1, EV2 reported equipment hook inadvertently opened.</li><li>- EV1's WVS EMU TV not received</li><li>- EV2 reported during helmet light battery charging, battery overheated (bad battery).</li><li>- IPS workstation crashed, delaying execute package</li><li>- CPS application on IPS crashed</li><li>- Sequential Still Video processing anomaly</li><li>- ICBC3D Camera stopped filming</li><li>- Erratic RCS jet L5D oxidizer injector temp transducer</li><li>- F5R Fuel Injector temp sensor failure</li><li>- OCA/Audio malfunctions</li></ul> |         |   |  |  |  |                        |                        |  |     |   |   |  |
|  <p>STS097-326-031 (8 December 2000) --- The STS-97 and Expedition 1 crews pose for an historic portrait (1<sup>st</sup> Shuttle visit to inhabited ISS): Front row are (left to right) STS-97 CDR Jett, EXP 1 CDR William M. Shepherd, &amp; STS-97 MS/Tanner. 2nd row (from the left) EXP 1 FE/Sergei K. Krikalev, STS-97 MS/Noriega, EXP 1 Soyuz CDR/Yuri P. Gidzenko, &amp; STS-97 PLT/Bloomfield. In the rear is STS-97 MS/Garneau representing the Canadian Space Agency (CSA). Krikalev and Gidzenko represent the Russian Aviation and Space Agency.</p>  |         |   |  |  |  |                        |                        |  |     |   |   |  |
|  <p>STS097-704-074 (9 December 2000) --- New ISS configuration following Endeavour undocking.</p>   |         |   |  |  |  |                        |                        |  |     |   |   |  |



# SPACE SHUTTLE MISSIONS SUMMARY







| FLT NO.   | ORBITER   | CREW (5)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET  | ORBIT   |  | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|--|---|---|--|--|---|--|---|--|---|
| STS-98/ISS 5A<br><br>SEQ FLT # 102<br><br>KSC-102<br><br>PAD: 39A-58 MLP-2<br><br><br>SEVENTH SHUTTLE FLIGHT TO ISS | OV-104 (Flight 23)<br><br>Atlantis<br><br>OMS PODS: LPO3-27 RPO4-23 FRC4-23 | CDR: Kenneth D. Cockrell (Flt 4 - STS 56, STS-69, STS-80)<br>P603/R159/V121/M140<br><br>PLT: Mark L. Polansky P604/R262/M228<br><br>M/S 1/EV2: Robert L. Curbeam (Flt 2 - STS-85)<br>P605/R225/V167/M195<br><br>M/S 2: Marsha S. Ivins (Flt 5 - STS-32, STS-46, STS-62, STS-81)<br>P606/R108/V77/F12<br><br>M/S 3/EV1: Thomas D. Jones (Flt 4 - STS-59, STS-68, STS-80)<br>P607/R177/V111/M155<br><br>SS EVA #58 EMU/TETHERED EVA #51 SCHEDULED EVA #52 DURATION 7:33:58<br><br>SS EVA #59 EMU/TETHERED EVA #52 SCHEDULED EVA #53 DURATION 6:50<br><br>SS EVA #60 EMU/TETHERED EVA #53 SCHEDULED EVA #54 DURATION 5:25 | KSC 39A<br>38:23:11:16Z<br>6:11:16 PM EST<br>6:13:02 PM EST<br>Wednesday 11 2/7/01 (8)<br><br>LAUNCH WINDOW: 4M42S USING PLT (IN-PLANE TIME)<br><br>EOM PLS: KSC TAL: ZZA TAL WX: MRN, BEN<br><br>SELECTED: RTLS: KSC 33 N/N TAL: ZZA 30 AOA: KSC 33 N/N PLS: EDW 22 N/N<br><br>TDEL: 0.00 0.22/0.06<br><br>MAX Q NAV: 727 735<br><br>SRB STG: 2:05.6 2:06<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN): 2:34 2:37<br><br>NEG RETURN: 3:53 3:55<br><br>PTA (U/S ): 4:48 4:46<br><br>PTM: 5:50 5:46<br><br>SE ZZA: 6:02 5:58<br><br>SE PTM: 6:51 6:51 | EDW 22, CONC EDW 47, CONC 28 51:20:33:06Z 12:33:06 PM PST<br><br>Tuesday 17 2/20/01 (6)<br><br>DEORBIT BURN: 51:19:27:20Z<br><br>X RANGE: 381 NM<br><br>ORBIT DIR: AL 27<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 1994 FT 51:20:33:06Z<br>VEL: 199 KGS 209 KEAS<br>HDOT: -2.5 FPS<br><br>TD NORM 195: 3540 FT<br><br>NLGTD: 5635 FT 51:20:33:18Z<br>VEL: 133 KGS 144 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE DEPLOY: 206 KEAS 51:20:33:08Z<br><br>BRK INIT: 58 KGS<br><br>DRAG CHUTE JETTISON: 64 KGS 51:20:33:36Z<br><br>BRK DECEL FPS <sup>2</sup> : AVE 4.7 PK 6.7<br><br>WHEELS STOP: 51:20:34:02Z 9964 FT<br><br>ROLLOUT: 7970 FT 56 SEC<br><br>WINDS: 20H TL OFFICIAL: 23020P27 SS: 20H 2R PK: 27H 3R | 104/104/109%<br><br>PREDICTED: 100/104.5/104.5/72/104.5<br><br>ACTUAL: 100/104.5/104.5/67/104.5<br><br>1 = 2052 (3)<br>2 = 2044 (5)<br>3 = 2047 (5)<br><br>ALL 3 BLOCK IIA ENGINES | BI-105<br><br>RSRM 77<br><br>ET-106 SLWT-11<br><br>ET IMPACT 1:26:23 MET<br><br>LAT: 1.73°S<br><br>LONG: 127.9°W | 51.60 (7)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 175.1 X 110.3 NM | OI-28 (1)<br><br>CARGO: 39162 LBS<br><br>PAYLOAD CHARGEABLE: 33286 LBS<br><br>DEPLOYED: 32270 LBS<br><br>NON-DEPLOYED: 583 LBS<br><br>MIDDECK: 983 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1030088 LBS NON-DEPLOYED: 1490535 LBS CARGO TOTAL: 3154339 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3274 FUEL BIAS: 818 FINAL TDDP: 2138 RECON: 1538<br><br>PAYLOADS: PLB: ISS-5A (DESTINY) U.S. LABORATORY RMS, ODS, SPDU<br><br>MIDDECK: SIMPLEX BMRRM (LON)<br><br>5 CRYO TK SETS 6 GH2 TANKS RMS 59<br><br>RMS USED FOR U.S. LAB TO NODE 1, PMA-2 TO LAB, AND EVA SUPPORT | <b>Brief Mission Summary:</b> The STS-98/5A mission, 7th mission to ISS, delivered and installed the U.S. Destiny Laboratory onto the forward port of the Unity Node. Destiny is the centerpiece for research on the ISS. The lab is 28 feet long by 14 feet wide. Atlantis landed at EAFB, CA after two consecutive days of wave offs at KSC, due to high winds, then clouds and rain on the third day.<br><br>KSC W/D: OPF 70, VAB 30 (2), PAD 28 (2) = 128 days total (Rollback to inspect SRB cables).<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 5/20/99 on 11/20/97<br>- Postponed to 10/28/99, 2/3/00, 3/2/00, 4/20/00, 8/29/00, and 1/18/01<br>- Postponed launch date to NET 2/6/01 when decision made to roll back to VAB and inspect/x-ray SRB cables (Replaced damaged cables).<br>- Set 2/7/01 launch date at FRR.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH WINDOW:<br>- The total launch window was 9M02S, which opened at 38:23:06:56Z and closed at 38:23:15:58Z. The decision was made to use the Preferred Launch Time (PLT) of 38:23:11:16Z (In-plane time) with a 4M42S launch window.<br><br>LAUNCH DELAYS:<br>- During T-9 hold, a step function was seen on APU 1 Turbine Speed (OA1 card 6). This proved to be a ground-processing problem; however, coming out of T-9 minute hold was 1m46s late, resulting in a launch delay of 1m46s. Launch occurred at 38:23:13:02Z, 6:13:02 PM EST on Wednesday, February 7, 2001.<br><br>TAL WX:<br>- Zaragoza (prime and selected) and Ben Guerir (2-engine TAL call) were forecast and observed GO. Moron was forecast and observed NO GO for ceiling and showers within 20 nm.<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set Plus: (1) PE Operational High Q WIN/JAN, (2) OMS assist is 4000 lbs, (3) 52 NM MECO, (4) Del Psi<br><br>FLIGHT DURATION CHANGES:<br>- Total extension 2 days plus two orbits and changed landing site to EDW.<br>- EDW was not called up for NEOM. Closed PLBD's, but waved-off landing at KSC on NEOM orbits 170 (Tig-24 mins) and 171 (Tig-36 mins) due to observed and forecast crosswind violations. Activated EDW for EOM+1. Closed PLBD's for EOM+1 but waved-off landing at KSC on orbit 186 for crosswind violations and orbit 187 due to observed and forecast crosswind violations and precipitation. Waved-off landing at EDW on orbits 188 and 189 due to forecast ceiling, crosswind, and precipitation violations. EOM+2. Waved-off landing at KSC on orbits 201 and 202 due to forecast of low ceiling and precipitation. Landed at EDW runway 22 on orbit 203 at 12:33:06 PST on Tuesday, February 20, 2001. |  |   |
|   |   |   |   |   |    |  |   |  |   |  |   |
|   |   |    |   |   | STS098-331-0017 (7-20 February 2001) --- RMS lifts Destiny from Atlantis payload bay for installation on ISS.  |  |   |  |   |  |   |
|   |   | Continued...   | Continued...  | Continued...  |  |  |   |  |   |  | Continued...  |



STS098-331-0017 (7-20 February 2001) --- RMS lifts Destiny from Atlantis payload bay for installation on ISS.




# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.        | ORBITER | CREW (5)   | LAUNCH SITE, LIFTOFF TIME,  | LANDING SITE/ RUNWAY, CROSSRANGE  | SSME-TL NOM-ABORT EMERG  | SRB RSRM AND ET   | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|----------------|---------|--|---|---|--|---|-------|--|-----|--|---|
| STS-98/ ISS 5A |         | Continued...<br><br>MCC WHITE FCR (32)<br><br><u>FLIGHT DIRECTORS:</u><br>A/E - L. E. Cain<br>LD/O1 - R. E. Castle<br>O2 - K. B. Beck<br>PLNG/O3 - B. P. Austin<br><br>ISS LD/O2 - A. F. Algate<br>ISS O1 - M. A. Kirasich<br>ISS O3 - M. J. Ferring<br>MOD - J. W. Bantle | Continued...<br><br>MECO CMD: 8:25.1 8:24.7<br><br>VI: 25928 25928<br><br>OMS-2: 43:46 43:45<br>127.1 FPS 127.1 FPS | Continued...<br><br>DENS ALT: 2334 FT<br><br>FLT DURATION: 12:21:20:04<br>S/T: 894:03:38:33<br>OV-102: 185:11:10:35<br><br>DISTANCE: 5,369,576 sm |  |   |       |  |     | Continued...   |   |
|                |         |    |   |    |  |  |       |  |     | <p><b>FIFTH SHUTTLE CREWMEMBER REPLACEMENT</b></p> <p>- Mark Lee was replaced by Curbeam in February 2001. (Fourth Shuttle crewmember replacement occurred on STS-85.)</p> <p><b>EVENTS:</b></p> <ul style="list-style-type: none"><li>- OMS assist at 2:16 MET, duration 102.2 seconds</li><li>- MC-4 at 40:15:41:20Z, 1:16:28:18 MET.</li><li>- Docked with ISS PMA3 Node 1 Nadir Port at 40:16:50:49Z, 01:17:37:47 MET</li><li>- Collision avoidance maneuver for ISS at 41:11:48:02Z, 02:12:35:00 MET Delta V +2.5 ft/sec, 186.5 by 199.4 nm</li><li>- RMS grappled PMA2 on Node 1 at 41:14:12Z, 2:14:59 MET. PMA2 installed on Z1 Truss at 41:17:00Z, 2:17:47 MET.</li><li>- U.S. Laboratory grappled in PLB at 41:17:22Z, 2:18:00 MET. U.S. Lab (Destiny) was attached to Node at 41:19:00Z, 2:19:47 MET.</li><li>- EVA 1 Start at 41:15:51Z, 2:16:36 MET. EVA duration 7H33M56S.</li><li>- First ISS Reboost maneuver Started at 42:17:13Z, 3:18:00 MET.</li><li>- Second Reboost maneuver Started at 42:18:18Z, 3:19:05 MET. Altitude increase of 3.6 nm, orbit 203.0 by 188.9.</li><li>- EVA 2 Start at 43:15:58Z, 4:16:45 MET, duration 6H50M.</li><li>- Third Reboost maneuver Started at 44:15:53:02Z, 5:16:40:00 MET lasted 4 hours.</li><li>- Fourth Reboost Started at 44:20:06:02Z, 5:20:53:00 MET. 5 nm altitude increase, orbit 206.5 by 193.7 nm</li><li>- EVA 3 Start at 45:14:30Z, 6:15:16:58 MET, duration 5H25M.</li><li>- Fifth Reboost at 45:23:08Z, 6:23:54:58 MET, 1.4 nm altitude increase, orbit 209 by 195 nm.</li><li>- Sixth Reboost at 46:15:23Z, Delta V of 4.4 fps, orbit 209.4 by 195.5 nm.</li><li>- Seventh Reboost at 46:16:56Z, duration 3h41m, Delta V 11.9 fps, orbit 212.5 by 199.2 nm.</li><li>- Hatch closed at 47:13:22Z, 8:14:08:58 MET.</li><li>- Undocked at 47:14:06Z, 8:14:53 MET.</li><li>- Relocated PMA2 from Node 1 to fwd CBM. Delivered and installed U.S. Lab on Node 1 fwd CBM and connected umbilicals, activated U.S. Lab core systems. Activated and C/O CMG's, then handed over attitude control to U.S. GN&amp;C system.</li><li>- ISS Visitor Time is 6:21:15:11.</li></ul> <p><b>TRANSFERS:</b></p> <ul style="list-style-type: none"><li>- To ISS: Dry cargo IVA 3036 lbs, U.S. Lab 29866 lbs, external EVA 368 lbs = total 33270 lbs. (Included H2O transfer to ISS: 10 CWC's = 993 lbs)</li><li>- Transfers from ISS to shuttle 872 lbs.</li></ul> <p><b>RENDEZVOUS #51:</b></p> <ul style="list-style-type: none"><li>- Rendezvous and dock with ISS at PMA3, Node 1 Nadir Port.</li></ul> |   |
|                |         |    |   |    |  |   |       |  |     | <p><b>SIGNIFICANT ANOMALIES:</b></p> <ul style="list-style-type: none"><li>- CDR and PLT HUD runway misalignment. PLT saw about 600 foot offset to the right of the runway, CDR was about half of this offset.</li><li>- PCA vent cover bolts did not fit 5/16-in socket. PCA vent bolts were difficult to start with power tool.</li><li>- EV2 EMU boot pressure point during EVA #1 and EVA #2.</li><li>- Broken connector bail linkage, one of rivets on connector bail broke.</li><li>- Sticky mini-workstations end effectors, occasionally stuck open.</li><li>- SASA P4 connector O-ring loose.</li><li>- Bad video for proshare video conferencing.</li><li>- STS-98 Vent Command error for Reboost 5.</li><li>- Ku-band radar Alpha gimbal angle error</li></ul>  |   |




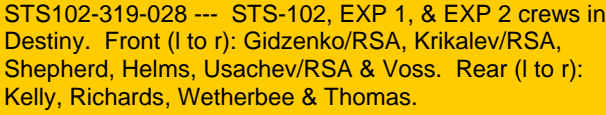

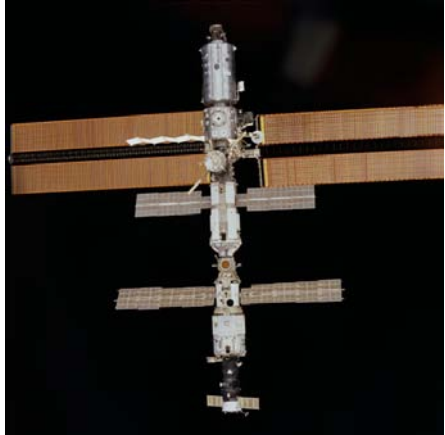


# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER  | CREW (10)<br>7 UP/7 DOWN<br>TITLE, NAMES & EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-ABORT<br>EMERG  | SRB<br>RSRM<br>AND<br>ET  | ORBIT   |  | FSW  | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|--|---|---|--|---|---|--|--|---|--|
| STS-102/<br>ISS 5A.1<br><br>SEQ<br>FLT # 103<br><br>KSC-103<br>ISS-5A.1<br><br>PAD<br>39B-45<br><br>MLP-3<br><br>EIGHTH<br>SHUTTLE<br>FLIGHT TO<br>ISS | OV-103<br>(Flight 29)<br><br>Discovery<br><br><br><br>OMS PODS:<br>LPO1-32<br>RPO3-30<br>FRC3-29 | CDR:<br>James D. Wetherbee<br>(Flt 5 - STS-32, STS-52,<br>STS-63, STS-86)<br>P608/R108/V80/M198<br><br>PLT:<br>James M. Kelly<br>P609/R263/M229<br><br>M/S 1 UP/EV3:<br>Andrew S. W. Thomas<br>(Flt 3 - STS-77, Up to Mir<br>on STS-89, Down STS-91)<br>P610/R213/V149/M186<br><br>M/S 2/EV4:<br>Paul Richards<br>P611/R264/M230<br><br>M/S 3 UP/EV1/EXP2 Flt<br>Eng 1:<br>James S. Voss<br>(Flt 5 - STS-44, STS-53,<br>STS-69, STS-101)<br>P612/R136/V85/M121<br><br>M/S 4 UP/EV2/EXP2 Flt<br>Eng 2:<br>Susan Helms<br>(Flt 5 - STS-54, STS-64,<br>STS-78, STS-101)<br>P613/R158/V108/F19<br><br>M/S 5 UP/EXP2 CDR:<br>Yury Usachev<br>(Russia)<br>(Flt 2 - STS-101)<br>P614/R256/V168/M223<br><br>M/S 3 DN/EXP1 Flt Eng:<br>Sergei Krikalev<br>(Russia)<br>(Soyuz UP, STS-102 DN)<br>(Flt 3 - STS-60, STS-88)<br>P615/R177/V154/M154<br><br>M/S 4 DN/EXP1 CDR:<br>William M. Shepard<br>(Flt 4 - STS-27, STS-41,<br>STS-52, Soyuz TM UP to<br>ISS, STS-102 DN)<br>P616/R96/V56/M87<br><br>Continued... | KSC 39B<br>67:11:42:09Z<br>6:42:09 AM EST (P)<br>6:42:09 AM EST (A)<br>Thursday 31<br>3/8/01 (7)<br><br>LAUNCH WINDOW:<br>4:59 USING PLT<br>(IN-PLANE TIME)<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 33 C/I/N<br>TAL: BEN 36<br>AOA: KSC 33 C/I/N<br>PLS: EDW 22 N/N<br><br>TDEL:<br>0.03 -0.118/-0.08<br><br>MAX Q NAV:<br>740 748<br><br>SRB STG:<br>2:05.6 2:04<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>2:24 2:24<br><br>NEG RETURN:<br>3:51 3:55<br><br>PTA (U/S 152):<br>4:48 4:48<br><br>DROOP:<br>4:43<br><br>PTM (U/S 152):<br>6:02 6:01<br><br>MECO CMD:<br>8:21.9 8:23.1<br><br>VI:<br>25823 25824<br><br>Continued... | KSC 15 (KSC 54)<br>80:07:31:41Z<br>2:31:41 AM EST<br><br>Wednesday 12<br>3/21/01 (7)<br><br>DEORBIT BURN:<br>80:06:26:06Z<br><br>X RANGE: 373 NM<br><br>ORBIT DIR: AR 9<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2839 FT<br>80:07:31:41Z<br>VEL: 199 KGS<br>203 KEAS<br>HDOT: -1.0 FPS<br><br>TD NORM 205:<br>2529 FT<br><br>NLGTD: 6190 FT<br>80:07:31:52Z<br>VEL: 165 KGS<br>159 KEAS<br>HDOT: -6.3 FPS<br><br>DRAG CHUTE<br>DEPLOY: 153 KEAS<br>80:07:31:55Z<br><br>BRK INIT: 98 KGS<br><br>DRAG CHUTE<br>JETTISON: 57 KGS<br>80:07:32:31Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 3.5 PK 5.4<br><br>WHEELS STOP:<br>80:07:33:06Z<br>14244 FT<br><br>ROLLOUT:<br>11244 FT<br>85 SEC<br><br>WINDS:<br>2H 9R<br>OFFICIAL:<br>2309P16 KTS<br>SS: 2H 9R<br>PK: 4H 16R<br><br>Continued... | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>1 = 2048 (3)<br>2 = 2053 (3)<br>3 = 2045 (4)<br><br>ALL BLOCK<br>IIA ENGINES<br><br>M 3 EOM:<br>WEIGHT:<br>218094 LBS<br>X CG:<br>1083.19<br><br>LANDING:<br>WEIGHT:<br>218031 LBS<br>X CG:<br>184.92<br><br> | BI-106<br><br>RSRM<br>78<br><br>ET-107<br><br>SLWT-12<br><br>ET<br>RPT: 283 K<br><br>ET<br>IMPACT<br>1:12:24<br>MET<br><br>LAT:<br>36.5°S<br><br>LONG:<br>158.1°W | 51.60<br>(8)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>126/86.2 NM<br><br>DEORBIT:<br>APOGEE:<br>206.5 NM<br>PERIGEE:<br>206 NM<br><br>ENTRY<br>VELOCITY:<br>25899 FPS<br><br>ENTRY<br>RANGE:<br>4391 NM | OI-28<br>(2)<br><br>CARGO:<br>37328 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>28739 LBS<br><br>DEPLOYED:<br>9649 LBS<br><br>NON-DEPLOYED:<br>3517 LBS<br><br>MIDDECK:<br>472 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1039900 LBS<br>NON-DEPLOYED:<br>1494524 LBS<br>CARGO TOTAL:<br>3191667 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3274 LBS<br>FUEL BIAS: 818<br>LBS<br>FINAL TDDP: 2847<br>RECON: 3031<br><br>PAYLOADS:<br>PLB:<br>ISS-5A.1<br>MPLM<br>PMA3<br>Logistics<br>GAS (2)<br>WSVFM<br>ICC<br>RMS, ODS<br><br>MIDDECK:<br>NONE<br><br>5 CRYO TK SETS<br>6 GN2 TANKS<br>RMS 68<br><br>RMS used for PMA3<br>install on lab, MPLM<br>grapple, deploy,<br>retrieve, and berth,<br>and EVA Support | <b>Brief Mission Summary:</b> STS-102, 8th mission to ISS, provided the first ISS crew changeout and, the first flight of the Italian-built Multipurpose Logistics Module (MPLM) named Leonardo. Among the MPLM cargo was the first scientific rack for U.S. Lab, Destiny, delivered on STS-98. With the ISS crew changeout, three crews participated in the STS-102 mission.<br><br>KSC W/D: OPF 84, VAB 8, PAD 24 = 113 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 3/16/00 on 1/28/99.<br>- Postponed launch to 4/13/00, 6/29/00, 10/19/00, 2/15/01, then 3/8/01. (Postponements caused by replacement of 9 damaged RCS thrusters, STS-98 launch postponements, and SRB x-rays/inspections and replacement of damaged cables.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH WINDOW:<br>- Launch window opened at 67:11:37:10Z and closed at 67:11:47:08Z for a total window of 9M58S.<br>- Selected the Preferred Launch Time (In-plane time) of 67:11:42:09Z, 6:42:09 AM EST, giving a launch window of 4M59S. Note: Sunrise was 2 minutes before launch. This was a daylight launch.<br><br>LAUNCH DELAYS: None<br>- Launch occurred on time at 67:11:42:09Z, 6:42:09 AM EST on Thursday, March 8, 2001.<br><br>TAL WX:<br>- Zaragoza (prime) was forecast NO GO for crosswinds (observed GO at launch and TAL landing times), Moron was NO GO for ceiling and showers within 20 nm. Ben Guerir (2-engine TAL call) was GO and selected.<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set Plus: (1) PE OPS High Q WIN/MAR, (2) OMS assist is 3717 lbs, (3) 52 nm MECO, (4) Del Psi<br><br>FLIGHT DURATION CHANGES:<br>- Total flight duration extensions 1 day plus 1 orbit.<br>- Extended 1 day for MPLM stowage exceeding planned time and 1 orbit for showers and low clouds at KSC. Plan was to land at KSC on orbit 201; however, KSC was forecast NO GO for the next 3 days. Waved-off the planned landing at KSC for orbit 201 due to weather forecast NO GO for showers and low clouds. Plan was to land at KSC on orbit 202; if not, then land at EDW on orbit 203. Minutes before Tig, the weather forecast was observed GO and forecast GO to land at KSC on orbit 202. (Observed crosswinds at landing time were 16 knots, a 4-knot violation.) Low ceiling at 4200 feet became scattered minutes before landing.<br><br>SHUTTLE NIGHT LANDING #17:<br>- Landed at KSC runway 15 on orbit 202 at 80:07:31:41Z, 2:31:41 AM EST Wednesday, March 21, 2001. Flight duration 12:19:49:32. Landed at KSC Orbit 101.<br><br>Continued... |   |  |

STS102-326-034 --- First Shuttle flight to transport EXP crews. ISS is lined up for rendezvous with Shuttle Discovery.






# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER  | CREW (10)<br>7 UP/7 DOWN<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES                   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.                 | SRB<br>RSRM<br><br>AND<br>ET | ORBIT<br><br>INC<br><br>HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|--|---|--|--|---|------------------------------|-------------------------------|--|-----|---|---|
| STS-102/<br>ISS 5A.1   |  | Continued...<br><br><u>M/S 5 DN/EXP1 Soyuz PLT:</u><br>Yuri Gidzenko<br>(Russia)<br>(Soyuz Up, STS-102 DN)<br>P617/R265/M231  | Continued...<br><br><u>OMS-2:</u><br>38:35 38:37<br>95.6 FPS 97.2 FPS<br>1:02 1:03.8 | Continued...<br><br><u>DENS ALT:</u><br>264 FT<br><br><u>FLT DURATION:</u><br>12:19:49:32<br><br><u>S/T:</u><br>906:23:28:05<br><br><u>OV-103:</u><br>230:01:27:50<br><br><u>DISTANCE:</u><br>5,357,432 sm |     |                              |                               |  |     |   | Continued...<br><br><u>FIRSTS/LASTS:</u><br>- First shuttle flight transporting an Expedition crew - Expedition 2 up, Expedition 1 down. Expedition 1 Crew launched on Flight 2R, Russian Soyuz rocket from Baikonur Cosmodrome, Kazakhstan on October 31, 2000 at 2:53 AM EST (305:07:53Z). Soyuz docked with ISS on 11/2/2000 at 4:21 AM EST (307:09:21Z). Expedition 1 Crew: CDR - William Shepherd, Soyuz pilot - Yuri Gidzenko, Flight Engineer - Sergei Krikalev.<br>- Shepherd flight time 80:07:31:41<br><br><u>EVENTS:</u><br>- T1 maneuver at 69:03:12:39Z, 1:15:30:30 MET, orbit 199.2 by 205.3. MC-4 at 69:04:33:21Z, 1:16:51:12 MET, orbit 199.1 by 206.1 nm.<br>- ISS capture at 69:06:38:26Z, 1:18:56:17 MET; Docked at PMA2 Lab Forward Port at 69:06:58:23Z; hatch opened at _____.<br>- EVA 1 Start at 2:17:29 MET and End at 3:02:25 MET, duration 8:56.<br>- PMA3 grappled, unberthed, and installed on Node 1 Port ACBM at 70:13:50Z.<br>- MPLM grapple at 71:03:36Z, 3:15:54 MET, and installed on Node 1 Nadir ACBM at 71:06:08Z, 3:18:46 MET.<br>- EVA 2 Start at 4:17:45 MET and End 5:00:06 MET, duration 6:21.<br>- Collision avoidance maneuver/ISS Reboost #1 at 73:12:12:09Z, 6:02:30:00 MET, duration 47M22S, orbit 200.1 by 210.8 nm, Delta V 11.8 fps.<br>- ISS Reboost #2 at 75:11:32:23Z, 7:23:50:14 MET, 7.2 fps, orbit 203 by 212 nm.<br>- ISS Reboost #3 at 76:09:17:45Z, 8:22:33:52 MET, 7.4 fps, orbit 204.5 by 213.7 nm.<br>- MPLM grappled at 9:20:22 MET, reberthed in orbiter, and ungrappled at 10:00:05 MET.<br>- ODS hatch was closed at 78:02:48Z, 10:15:06 MET.<br>- Undocked at 78:04:31:53Z, 10:16:50 MET.<br>- Transfers: Shuttle to ISS: 9649 lbs cargo plus 980 lbs water in 10 CWC's. ISS to Shuttle: 1647 lbs cargo.<br>- Crew rotation (Expedition 1 to Expedition 2). Relocated PMA3 from Node 1 Nadir to Node 1 Port. Berthed MPLM to Node 1 Nadir. Transferred RSP's, RSR's, HRF, ISPR, etc. to ISS.<br>- Krikalev flew two long-duration missions to Mir.<br>- ISS Visitor Time is 8:21:33:30<br><br><u>RENDEZVOUS #52:</u><br>- Rendezvous and dock with ISS at PMA2 Lab Forward Port.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- Flash evaporator left topping Evaporator Duct Heater String A failure<br>- WCS Fan Sep Rotary Switch 2 position failure<br>- Freon® loop flow degradation<br>- EV1 burning sensation in eyes during Airlock depress<br>- PMA3 J603 loose O-ring EVA<br>- Unable to remove PMA3 P608 connector cap<br>- TCS failure during rendezvous termination operation<br>- OCAC fan failure (running slow at all speed settings)<br>- Right OMS Vapor Isolation Valve #2 anomaly<br>- C&W limits set volts pushbutton rotary switch down position not working on panel R13U |
| Continued...   |  | SS EVA #61<br>EMU/TETHERED<br>EVA #54<br>SCHEDULED EVA #55<br>DURATION 8:56<br><br>SS EVA #62<br>EMU/TETHERED<br>EVA #55<br>SCHEDULED EVA #56<br>DURATION 8:21<br><br>MCC WHITE FCR (33)<br><br><u>FLIGHT DIRECTORS:</u><br>A/E - N. W. Hale<br>LD/O1 - J. P. Shannon<br>O2 - P. S. Hill<br>PLNG/O3 - P. F. Dye<br>MOD - J. W. Bantle<br><br><u>STATION:</u><br>LD/O1 - R. E. LaBrode<br>O2 - S. P. Davis<br>PLNG/O3 - R. E. Castle |  |  |     |                              |                               |  |     |   | STS102-319-028 --- STS-102, EXP 1, & EXP 2 crews in Destiny. Front (l to r): Gidzenko/RSA, Krikalev/RSA, Shepherd, Helms, Usachev/RSA & Voss. Rear (l to r): Kelly, Richards, Wetherbee & Thomas.   |
|  |    |   |  |  |  |                              |                               |  |     |   | STS102-712-005 --- Backdropped against the blackness of space, the ISS as viewed after Shuttle separation.  |
| JSC2000-E-06202 --- At their MOCR console, Flight Directors Wayne Hale (left) and John Shannon discuss a mission detail. |  |   |  |  |   |                              |                               |  |     |   | STS102-312-004 --- During EVA 1 Voss (and Helms – out of frame) prepared for MPLM docking to ISS Unity Node.  |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-136 - STS-100/6A

| FLT NO.   | ORBITER  | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.  | SRB RSRM<br><br>AND ET  | ORBIT<br><br>INC HA/HP |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|--|---|---|--|---|------------------------|---|--|---|---|
| STS-100/ISS 6A<br><br>SEQ FLT # 104<br><br>KSC-104<br><br>PAD: 39A-59<br><br>ISS-6A<br><br>MLP-1<br><br>NINTH SHUTTLE FLIGHT TO ISS | OV-105 (Flight 16)<br><br>Endeavour<br><br><br><br>OMS PODS: LPO4-23 RPO1-30 FRC5-16 | CDR: Kent V. Rominger (Flt 5 - STS-73, STS-80, STS-85, STS-96) P618/R200/V131/M174<br><br>PLT: Jeffrey S. Ashby (Flt 2 - STS-93) P619/R251/V169/M218<br><br>M/S 1/EV1: Chris A. Hadfield (Flt 2 - STS-74) P620/R202/V170/M178<br><br>M/S 2: John L. Phillips CSA/Canada P621/R266/M232<br><br>M/S 3/EV2: Scott E. Parazynski (Flt 4 - STS-66, STS-86, STS-95) P622/R187/V144/M165<br><br>M/S 4: Umberto Guidoni (Flt 2 - STS-75) (ESA-Italy) P623/R212/V171/M185<br><br>M/S 5: Yuri V. Lonchokov (Russia) P624/R267/M233 | KSC PAD 39A 109:18:40:41:99Z 2:40:42 PM EDT (P) 2:40:42 PM EDT (A) Thursday 32 4/19/01 (14)<br><br>LAUNCH WINDOW: 4M49S BASED ON IN-PLANE TIME (PLT)<br><br>EOM PLS: KSC TAL: ZZA TAL WX: MRN, BEN<br><br>SELECTED: RTLS: KSC 33/N/N TAL: MRN 20/N/N AQA: KSC 33/N/N PLS: KSC 15/N/N<br><br>TDEL: 0.10 -0.018/0.02<br><br>MAX Q NAV: 725 728<br><br>SRB STG: 2:03.7 2:04<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN): 2:33 2:33<br><br>NEG RETURN: 3:54 3:55<br><br>PTA (U/S 243): 4:47 4:46<br><br>PTM (U/S 243): 5:56 5:50<br><br>SE TAL (ZZA): 6:04 6:03<br><br>SE PTM (U/S 701): 6:53 6:53<br><br>MECO CMD: 8:24.2 8:25.4 | EDW 22, CONC EDW 48, CONC 29 121:16:10:43Z 9:10:43 AM PDT Tuesday 18 5/1/01 (10)<br><br>DEORBIT BURN: 121:15:02:47Z<br><br>X RANGE: 527 NM<br><br>ORBIT DIR: AL 28<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2159 FT 121:16:10:43Z VEL: 207 KGS 195 KEAS HDOT: -3.6 FPS<br><br>TD NORM 195: 2148 FT<br><br>NLGTD: 5410 FT 121:16:10:53Z VEL: 157 KGS 149 KEAS HDOT: -5.2 FPS<br><br>DRAG CHUTE DEPLOY: 191 KEAS 121:16:10:45Z<br><br>BRK INIT: 106 KGS<br><br>DRAG CHUTE JETTISON: 53 KGS 121:16:11:16Z<br><br>BRK DECEL FPS <sup>2</sup> : AVE 6.5 PK 10.6<br><br>WHEELS STOP: 121:16:11:34Z 10123 FT<br><br>ROLLOUT: 7964 FT 51 SEC<br><br>WINDS: 2H 3R OFFICIAL: 28006PT0 SS: 5H 4R PK: 8H 7R | 104/104/109%<br><br>PREDICTED: 100/104.5/104.5/72/104.5<br><br>ACTUAL: 100/104.5/104.5/72/104.5<br><br>1 = 2054 (3)<br>2 = 2043 (6)<br>3 = 2049 (5)<br><br>ALL BLOCK IIA ENGINES<br><br>M 3 EOM: WEIGHT: 220693 LBS X CG: 1083.79<br><br>LANDING: WEIGHT: 220556 LBS X CG: 1085.49 | BI-107 RSRM 79 ET-108 SLWT-13<br><br>BRKUP: 283 K<br><br>ET IMPACT 1:26:38 MET<br><br>LAT: 1.23°S<br><br>LONG: 127.14°W | 51.60 (9)              | DIRECT INSERTION<br><br>POST OMS-2: 178.7 X 85.7 NM<br><br>DEORBIT: APOGEE 219 NM PERIGEE 204 NM<br><br>ENTRY VELOCITY: 25919 FPS<br><br>ENTRY RANGE: 4387 NM | OI-28 (3)<br><br>CARGO: 38330 LBS<br><br>PAYLOAD CHARGEABLE: 29472 LBS<br><br>DEPLOYED: 6346 LBS<br><br>NON-DEPLOYED: 4282 LBS<br><br>MIDDECK: 781 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1046246 LBS NON-DEPLOYED: 1499587 LBS CARGO TOTAL: 3229997 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3274 FUEL BIAS: 818 FINAL TDDP: 2670 RECON: 2296<br><br>PAYLOADS: PLB: ISS-6A ICBC3D MPLM SLP-06A RMS, ODS<br><br>MIDDECK: DTO EMU H/W EVA Tools<br><br>5 CRYO TK SETS 7 GN2 TANKS RMS 61<br><br>RMS used to grapple, deploy, retrieve, and berth Spacelab Pallet and MPLM, and for EVA Support | <b>Brief Mission Summary:</b> STS-100/6A, 9th mission to ISS, delivered and installed the ISS Canadarm2 robotic arm. The first job for the arm was to attach a new airlock on ISS, to be delivered on the next flight, STS-104. In addition, the second MLP, Raffaello, flown on this flight, transferred needed cargo to ISS and returned items from ISS to Earth.<br><br>KSC W/D: OPF 82, VAB 5, PAD 23 = 110 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 12/2/99<br>- Postponed launch to 4/20/00, then 7/13/00, 7/27/00, 11/30/00.<br>- Postponed launch to 4/19/01 on 2/24/00.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH WINDOW:<br>- Launch window opened at 109:18:36:12Z and closed at 109:45:31Z, giving a total window of 9M29S. The Preferred Launch Time (PLT) was 109:18:40:42 (In-plane time) 2:40:42 PM EDT, giving a launch window of 4M49S.<br><br>LAUNCH DELAYS: None<br>- Launch occurred on time at 109:18:40:42Z, 2:40:42 PM EDT on Thursday, April 19, 2001.<br><br>TAL WX:<br>- Zaragoza (prime) was NO GO for head wind violations until approximately L-3 minutes when head winds dropped to 25 knots. Moron (selected early) was GO and decision made to stay with a solid Moron. Ben Guerir was NO GO for forecast and observed showers/virga.<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set Plus: (1) PE Operational High Q TRN/APR, (2) OMS assist is 4000 lbs, (3) 52 nm MECO, (4) Del Psi<br><br>FLIGHT DURATION CHANGES:<br>- Total ext 1 day + 2 orbits. Planned landing was on orbit 170.<br>- Extended 1 docked day due to ISS C&C MDM (computer) problems resulting in a planned landing on orbit 185. Did not close PLBD's and waved-off landing at KSC on orbits 185 and 186 due to forecast of showers, crosswinds, and low ceiling weather violations. Similar weather violations were forecast for KSC for the next 2 days. EDW had been called up for EOM because KSC WX violations were forecast to continue through the majority of the week. Decision was made to land at EDW on orbit 187. KSC WX was observed NO GO on the two extension days. Weather observations forecast KSC was NO GO for all 3 days. EDW was GO on EOM+1. Landed on EDW runway 22 on orbit 187 at 121:16:10:43Z, 8:10:43 AM PST on May 1, 2001, 11:21:30:01 MET. |   |
|    |  |  |   |   |  |   |                        |   |  |   |   |
|   |  |  |   |   |  |   |                        |   |  |   |   |
|   |  |  |   |   |  |   |                        |   |  |   |   |
|   |  | ISS02-E-5829 (21 April 2001) --- Endeavour, with MPLM Raffaello & Canadarm2 on board, approaching ISS for docking.   |   |   |  |   |                        |   |  |   |   |
|   |  | Continued...   |   |   |  |   |                        |   |  |   |   |

Continued...

Continued...



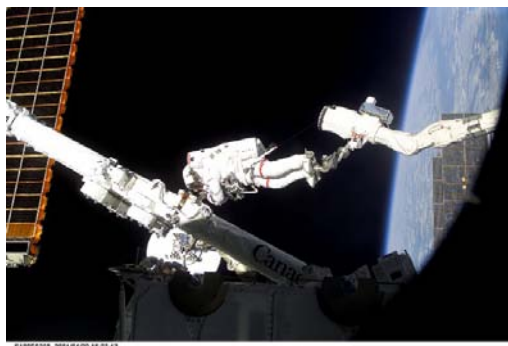

Continued...

ISS02-E-5829 (21 April 2001) --- Endeavour, with MPLM Raffaello & Canadarm2 on board, approaching ISS for docking.

Continued...





# SPACE SHUTTLE MISSIONS SUMMARY


| FLT NO.   | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG  | SRB RSRM | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|--|---|--|--|----------|-------|--|-----|--|---|
| STS-100/ISS 6A<br><br>Continued...  |         | Continued...<br><br>SS EVA #63<br>EMU/TETHERED EVA #56<br>SCHEDULED EVA #57<br>DURATION 7:09:51<br><br>SS EVA #64<br>EMU/TETHEREDEV A #57<br>SCHEDULED EVA #58<br>DURATION 7:39:23<br><br>MCC WHITE FCR (34)<br><br>FLIGHT DIRECTORS:<br>A/E - L. E. Cain<br>LD/O 1 - P. L. Engelauf<br>O 2 - K. B. Beck<br>PLNG/O3 - B. P. Austin<br>MOD - J. M. Hefflin<br><br>STATION:<br>LD/O 1 - J. M. Curry<br>O 2 - M. J. Ferring<br>PLNG/O 3- R. E. Castle | Continued...<br><br>VI:<br>25930      25920<br><br>OMS-2:<br>43:40      43:42 | Continued...<br><br>DENS ALT:<br>3925 FT<br><br>FLT DURATION:<br>11:21:30:01<br>S/T:<br>918:20:58:06<br><br>OV-105:<br>167:03:14:03<br><br>DISTANCE:<br>4,910,188 sm | <br><b>STS100-341-003 --- STS-100 and EXP 2 crews in-flight portrait in Destiny. Bottom, from left: Hadfield/CSA, Guidoni/ESA-Italy, Rominger, Susan J. Helms/EXP2. Middle row: James S. Voss/EXP2, Yuri V. Usachev/EXP2, &amp; Lonchakov/RSA. Top: Parazynski, Phillips, &amp; Ashby.</b> |          |       |  |     | Continued...<br><br><b>EVENTS:</b><br>- MC-4 (RCS) at 1:18:00:36 MET, orbit 199.1 by 206.1 nm<br>- Docked at ISS PMA2 Lab Forward Port at 11:14:10:42Z<br>- EVA 1 Start at 2:17:04:41 MET, duration 7:09:51<br>- RMS grappled the Spacelab Pallet, unberthed from orbiter, and installed on Lab Cradle Assembly at 2:16:07:18 MET<br>- ISS hatch opening and crew ingress into ISS at approximately 3:14:40 MET.<br>- MPLM in PLB at 3:19:45 MET grappled and positioned over Node 1 Nadir CBM and installed at 3:21:04 MET.<br>- First ISS Reboost maneuver Started at 4:01:09:54 MET, duration 59M36S, Delta V 7.41 fps, orbit 205.5 by 212.2, raised orbit 2.1 nm.<br>- EVA 2 Start at 4:17:53:12 MET, duration 7h39M22S<br>- Second ISS Reboost maneuver Started at 7:16:40:00 MET (RCS), ended at 1 hour, Delta V was 15.9 fps, orbit 210 by 206.<br>- RMS berthed MPLM in PLB and powered down at 8:02:43 MET. SSRMS to RMS handoff of SLP berthed at 9:02:02 MET.<br>- Delivered and installed SSRMS and connected cables to U.S. Lab. UHF antenna on U.S. Lab, removed starboard ECOMM antenna. Delivered and installed express racks with payloads. Replaced failed CMC MDM #1.<br>- Undocked at 119:17:34:04Z (Extended flight 1 docked day due to ISS C&C MDM and Node MDM problems).<br>- Transferred 6346 lbs cargo to ISS and 1608 lbs from ISS to Shuttle. Transferred 1380 lbs water in 14 CWC's.<br>- ISS Visitor time is 8:03:23:22.<br><br><b>RENDEZVOUS #53:</b><br>- Rendezvous and dock with ISS at PMA2 Lab Forward Port<br><br><b>SIGNIFICANT ANOMALIES:</b><br>- FES Feedline B Mid 2 Htr 1 failed off<br>- RMS End Effector Capture Switch sticky<br>- WSB 3 anomalous temperature response when operating on WSB 3B controller<br>- Humidity Separator B water carryover<br>- RCS Jet R5D low chamber pressure<br>- EV1 eye irritation during EVA 1 and EVA 2 (Disposable in-suit drink bag leaked)<br>- ISS Early Comm Antenna connector fell apart<br>- Video Signal Converter failed to release from SLP during EVA 2<br>- SIGI data check bad status indications<br>- SRB - Unburned propellant (3 percent) in RH Forward Booster Separation Motor (BSM). Conclusion is water intrusion.<br>- LOMS POD inboard Y-web dithering/erratic System A Heater<br>- In video of launch, the lower left hand OMS Pod TPS appeared to be flexing during SSME startup. Similar but smaller motion has been seen on the pods in the past. |   |
|                                 |         |    |   |    |  |          |       |  |     |  |   |
| JSC2001-E-12120 -- Ascent Flight Director LeRoy Cain (left) discusses mission with FD Jeffrey Bantle in the MOCR. |         | STS100-E-5238 (22 April 2001) --- Hadfield/MS representing CSA, stands on one Canadian-built robot arm (RMS) to work with another one, called Canadarm2, for ISS.  |   | STS100-E-5958 -- ISS, sporting a readily visible new addition in the form of the Canadarm2 robotic arm, as seen from Shuttle post separation.                        |  |          |       |  |     |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.        | ORBITER                     | CREW (5)   | LAUNCH SITE, LIFTOFF TIME,  | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG   | SRB RSRM   | ORBIT      |   | FSW       | PAYLOAD WEIGHTS,  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|----------------|-----------------------------|--|---|--|---|--|------------|---|-----------|---|--|
|                |                             | TITLE, NAMES & EVA'S   | LANDING SITES, ABORT TIMES  | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N.  | AND ET   | INC        | HA/HP   |           | PAYLOADS/ EXPERIMENTS   |  |
| STS-104/ISS 7A | OV-104 (Flight 24) Atlantis | CDR: Steven W. Lindsey (Flt 3 - STS-87, STS-95) P625/R229/V131/M200<br><br>PLT: Charles O. Hobaugh P626/R268/M234<br><br>M/S 1/EV1: Michael L. Gernhardt (Flt 4 - STS-69, STS-83, STS-94) P627/R198/V138/M173<br><br>M/S 2: Janet L. Kavandi (Flt 3 - STS-91, STS-99) P628/R243/V158/F32<br><br>M/S 3/EV2: James F. Reilly (Flt 2 - STS-89) P629/R234/V172/M204<br><br>SS EVA #65 EMU/TETHERED EVA #58 SCHEDULED EVA #59 DURATION 5:59<br><br>SS EVA #66 EMU/TETHERED EVA #59 SCHEDULED EVA #60 DURATION 6:29:20<br><br>SS EVA #67 DOCKED EVA 1 FROM QUEST A/L #1 EMU/TETHERED EVA #60 SCHEDULED EVA #61 DURATION 4:01:30<br><br>MCC WHITE FCR (35)<br><br>FLIGHT DIRECTORS: A/E/O 2 - N. W. Hale LD/O 1 - P. S.Hill PLNG/O3 - J. P. Shannon<br><br>ISS LD/O 2 - M. A. Kirsich ISS O 1 - S. P. Davis ISS PLNG/O3 - J. M. Hanley MOD - R. E. Castle | KSC 39B 193:09:03:59Z 5:03:59 AM EDT (P) 5:03:59 AM EDT (A) Thursday 33 7/12/01 (7)<br><br>LAUNCH WINDOW: 7M57S USING PLT (IN-PLANE TIME)<br><br>EOM PLS: KSC TAL: ZZA TAL WX: MRN<br><br>SELECTED: RTLS: KSC 33 N/N TAL: ZZA 30 N/SF AOA: KSC 15 N/N PLS: EDW 22 N/N<br><br>TDEL: 0.01 0.012/0.05<br><br>MAX Q NAV: 732 732<br><br>SRB STG: 2:02.1 2:02<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN): 2:23 2:26<br><br>NEG RETURN: 3:54 3:57<br><br>PTA (U/S 159): 4:39 4:36<br><br>SE OPS 3: 5:20 NC<br><br>PTM (U/S 159): 6:02 6:02<br><br>SE TAL (ZZA): 6:03 6:06<br><br>SE PTM (U/S 755): 6:49 6:52<br><br>Continued... | KSC 15 (KSC 55) 206:03:38:55Z 11:38:55 PM EDT<br><br>Tuesday 19 7/24/01 (10)<br><br>DEORBIT BURN: 206:02:31:35Z<br><br>X RANGE: 391 NM ORBIT DIR: AL 29 AIM PT: NOMINAL<br><br>MLGTD: 2183 FT 206:03:38:55Z VEL: 198 KGS 199 KEAS HDOT: -1.4 FPS<br><br>TD NORM 195: 2499 FT<br><br>NLGTD: 5442 FT 206:03:39:06Z VEL: 148 KGS 148 KEAS HDOT: -5.7 FPS<br><br>DRAG CHUTE DEPLOY: 191 KEAS 206:03:38:58Z<br><br>BRK INIT: 56 KGS<br><br>DRAG CHUTE JETTISON: 57 KGS 206:03:39:39Z<br><br>BRK DECEL (FPS): AVE 1.6 PK 5.1<br><br>WHEELS STOP: 206:03:40:06Z 13041 FT<br><br>ROLLOUT: 10858 FT 68 SEC<br><br>WINDS: 4H 1L OFFICIAL: 13005P07 SS: 5H 2L PK: 6H 3L<br><br>Continued... | 104/104/ 109%<br><br>PREDICTED: 100/104.5/ 104.5/72/ 104.5<br><br>ACTUAL: 100/104.5/ 104.5/72/ 104.5<br><br>1 = 2056 (1) 2 = 2051 (2) 3 = 2047 (6)<br><br>ENG 1 & 3 BLOCK IIA<br><br>ENG 2 BLK II<br><br>M 3 EOM: WEIGHT: 209142 LBS X CG: 1083.81<br><br>LANDING: WEIGHT: 209097 LBS X CG: 1085.59 | BI-108<br><br>RSRM 80<br><br>ET-109<br><br>SLWT 14<br><br>ET RPT: 283 K<br><br>ET IMPACT 1:14:17 MET<br><br>LAT: 36.32 °S LONG: 158.55°W | 51.60 (10) | DIRECT INSERTION<br><br>POST OMS-2: 127 X 85 NM<br><br>DEORBIT: APOGEE: 211.0 NM PERIGEE: 207.5 NM<br><br>VELOCITY: 25905 FPS<br><br>ENTRY RANGE: 4405 NM | OI-28 (4) | CARGO: 35135 LBS<br><br>PAYLOAD CHARGEABLE: 26424 LBS<br><br>DEPLOYED: 19792 LBS<br><br>NON-DEPLOYED: 6060 LBS<br><br>MIDDECK: 582 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1066028 LBS NON-DEPLOYED: 1506229 LBS CARGO TOTAL: 3265132 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3274 FUEL BIAS: 818 FINAL TDDP: 2884 RECON: 2990<br><br>PAYLOADS: PLB: ISS-7A ISS Airlock Spacehab Double Pallet (O2 and N2 TKS) ICBC3D RMS, ODS<br><br>MIDDECK: ICBC SPT EQUIP, EMU H/W, EVA TOOLS<br><br>5 CRYO TK SETS 7 GH2 TKS RMS 62<br><br>RMS used to view A/L Installation, OSVS, and EVA Support | <b>Brief Mission Summary:</b> STS-104, 10th mission to ISS, delivered, installed, and operated the first ISS airlock, Quest – “Giving ISS a Doorway to Space”. Quest provided the capability for conducting EVA’s without the presence of Shuttle, for EVA’s using either Russian Orlan or U.S spacesuits, and for a new pre-breathing protocol to prevent “the bends”. Also, this was first mission support from Houston’s ISS Flight Control Room (BFCR).<br><br>KSC W/D: OPF 82, VAB 11, PAD 21 = 114 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined launch date of 8/24/00 on 7/29/99<br>- Postponed launch date to 2/8/01 on 11/10/99<br>- Postponed launch date to 5/15/01 on 2/24/01<br>- Postponed launch date to 7/12/01<br><br>LAUNCH SCRUBS: NONE<br><br>LAUNCH WINDOW:<br>- Launch window opened at 193:08:59:00Z and closed at 193:09:11:56Z in two panes with a 10 second cutout between panes, resulting in a total window of 12M56S. The Preferred Launch Time was 193:09:03:59Z (Pane 1 In-Plane Time) resulting in a launch window of 7M57S.<br><br>LAUNCH DELAYS: NONE<br>- Launch occurred On-Time at 193:09:03:59Z (5:03:59 AM EDT) on Thursday, July 12, 2001.<br><br>TAL WX:<br>- Zaragoza (Prime and Selected) forecast and observed GO, Moron (2-Eng TAL Call) was forecast and observed GO. Ben Guerir was not available due to security concerns (BEN was forecast and observed GO).<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set Plus: PE Operational High Q SUM/JUL, 52 nm MECO, and Del Psi<br><br>SHUTTLE NIGHT LAUNCH #26<br><br>SHUTTLE NIGHT LANDING #18<br>- Landed on orbit 201 on KSC runway 15 at 206:03:38:55Z, 11:38:55 PM EDT on 7/24/2001.<br><br>FLIGHT DURATION CHANGES:<br>- Total extension 2 days. One day for ISS Ops and one day for weather at KSC.<br>- Extended Flight 1 day due to delays in completing ISS activities primarily caused by airlock leaks.<br>- Closed PLBD’s and fluid loaded crew for planned landing on orbit 186 at KSC at 11:19:32:47 MET. At Tig -10 mins, waved-off when small cluster of showers formed SW of SLF with forecast to be within 30 nm at landing. At Tig -11 mins, waved-off landing on orbit 187 at KSC with observed precipitation and low ceiling within 30 nm and forecast precipitation within 30 nm at landing time.<br><br>Continued... |









STS104-E-5178 --- STS-104 & EXP2 crews pose in new Quest airlock: Front: PLT Hobaugh. 2nd row, from left: Reilly/MS, CDR Lindsey, CDR/EXP2 Yuri V. Usachev & Gernhardt/MS. In rear: Kavandi/MS, James S. Voss/EXP2/FE and Susan J. Helms EXP2/FE.



STS104-E-5178 --- STS-104 & EXP2 crews pose in new Quest airlock: Front: PLT Hobaugh. 2nd row, from left: Reilly/MS, CDR Lindsey, CDR/EXP2 Yury V. Usachev & Gernhardt/MS. In rear: Kavandi/MS, James S. Voss/EXP2/FE and Susan J. Helms EXP2/FE.

# SPACE SHUTTLE MISSIONS SUMMARY

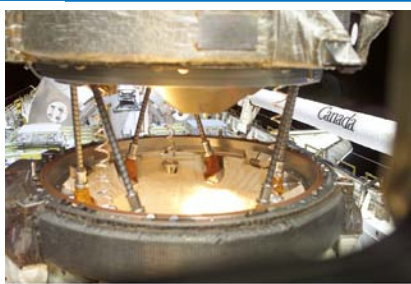
| FLT NO.   | ORBITER  | CREW (5)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES          | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|---|--|---|--|--------------------|-----------------------|--|-----|--|---|
| STS-104/ISS 7A  | 1st Flight Blk II SSME (P&W HPFTP) Courtesy: Dan Hausman/P&W/Rocketdyne/ KSC | Continued...<br><br>MECO CMD: 8:23.8<br><br>VI: 25824<br><br>OMS-2: 38:29<br>96.7 FPS   | Continued...<br><br>8:26<br><br>25823<br><br>38:33<br>96.6 FPS | Photo at right: JSC2001-E-21323 -- During Pre-launch in MCC (lt to rt) Robert Gest /USA ; Steven Hawley, Dep. Dir. FCOD; Lee Briscoe, Ch. Eng. MOD; & Milt Hefflin, Ch. Flt Director's Office.<br><br>DENS ALT: 1346 FT<br><br>FLT DURATION: 12:18:34:56<br><br>S/T: 931:15:33:02<br><br>OV-104: 198:05:45:31<br><br>DISTANCE: 5,309,429 sm |  |                    |                       |  |     | Continued...<br><br>FLIGHT DURATION CHANGES:<br>- Second Extension Day. Called up EDW for EOM+1. Landed on first KSC opportunity on orbit 201 on runway KSC 15 at 206:03:38:55Z, 12:18:34:56 MET, 11:38:55 PM EDT (Tuesday, July 24, 2001 EDT).<br><br>FIRSTS/LASTS:<br>- First flight of SSME with alternate Pratt & Whitney HPFTP (S/N 2051) Block II engine<br>- First operational use of SSRMS since delivery on STS-100/6A. Used to grapple Airlock and install on Node 1 Starboard Port.<br>- First use of exercise pre-breathe of pure oxygen to purge nitrogen from EVA crew for EVA 3 (12 minute pre-breathe).<br>- First use of ISS Joint Airlock for EVA (by Shuttle Crew on EVA 3).<br><br>EVENTS:<br>- Docked at ISS PMA2 Lab Fwd Port. ISS contact at 1:18:04:02 MET, 195:03:08:01Z; Docking complete at 1:18:19:16 MET, 195:03:23:15Z.<br>- ISS Hatch open (first) 1:20:24 MET, 195:05:28Z.<br>- Airlock grapple.<br>- EVA 1 started at 2:18:07 MET, 196:03:12Z; ended at 3:00:06 MET, 196:09:11Z, duration 5H59M.<br>- ISS Reboost 1 maneuver started at 196:01:18:06Z, 3:16:14:07 MET, Delta V=6.8 ft/sec, altitude increase 2.3 nm, altitude 206 by 201 nm.<br>- EVA 2 started at 199:03:05Z; ended at 199:09:34Z, duration 6H29M20S.<br>- ISS Reboost 2 maneuver started at 199:09:59:12Z, 6:00:55:13 MET, delta V=6.9 ft/sec, altitude increase 2.0 nm, altitude 207.8 by 203.7 nm.<br>- ISS Reboost 3 maneuver started at 200:07:35:04Z, 6:22:31:05 MET, delta V=14.9 ft/sec, altitude increase 4.3 nm, altitude 211.1 by 208.6 nm.<br>- EVA 3 started by 202:08:35Z, and ended at 202:08:37Z, duration 4H01M30S. EVA from Joint Airlock.<br>- Delivered and installed ISS Joint Airlock on Node 1 Stbd port using SSRMS. Delivered and installed four HPGT's (two O2 and two H2) on Airlock. End of ISS Phase 2.<br>- ISS Hatch close (Final) at 9:17:51 MET, 203:02:55Z.<br>- Undocked at 9:19:50:00 MET, 203:04:53:59 Z.<br>- Transfers: Shuttle to ISS: 19782 lbs cargo (includes Airlock, 13299 lbs) plus 897 lbm water in 9 CWC's. ISS to Shuttle: 626 lbs.<br>- ISS Visitor Time is 8:01:45:58.<br><br>RENDEZVOUS #54:<br>- Rendezvous and dock with PMA2 Lab Forward Port |   |
|   |  |   |  |   |  |                    |                       |  |     |   |   |
|    |  | Photo at Right: STS104-E-5237 --- Astronaut James F. Reilly participates in a bit of space history as he joins astronaut Michael L. Gernhardt (out of frame) in utilizing the new Quest airlock for the first ever space walk to egress from ISS. |  |   |  |                    |                       |  |     |    |   |
| JSC2001-01944 (June 2001) --- First mission from ISS MCC: Members of Orbit 2 team pose for group portrait in the ISS flight control room (BFGR) in Houston's MCC. Orbit 2 Flight Director Mark Kirasich (blue shirt) stands near front at frame center. Lisa Holmesly, lead operations planner for ISS, is standing in front of Kirasich between the two logos. |  |   |  |   |  |                    |                       |  |     |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY





| FLT NO.          | ORBITER                        | CREW (7 UP/7 DOWN)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET                        | ORBIT INC HA/HP   | FSW       | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|------------------|--------------------------------|---|--|---|---|--|---|-----------|--|--|
| STS-105/ISS 7A.1 | OV-103 (Flight 30) (Discovery) | CDR: Scott J. Horowitz (Flt 4 - STS-75, STS-82, STS-101) P630/R210/V135/M183<br>PLT: Frederick W. Sturckow (Flt 2 - STS-88) P631/R247/V173/M215<br>M/S 1/EV2: Patrick G. Forrester P632/R269/M235<br>M/S 2/EV1: Daniel T. Barry (Flt 3 - STS-72, STS-96 P633/R209/V155/M182)<br>M/S 3 UP/EXP 3 CDR: Frank L. Culbertson, Jr. (Flt 3 - STS-38, STS-51) P634/R116/V95/M105<br>M/S 4 UP/EXP 3 SPLT: Vladimir N. Dezhurov (Russia) (Flt 2 - STS-71) P635/R195/V174/M170<br>M/S 5 UP/EXP 3 Flt Eng: Mikhail Tyurin (Russia) P636/R270/M236<br>M/S 3 DN/EXP 2 Flt Eng 1: James S. Voss (Flt 5 - STS-44, STS-53, STS-69, STS-101, STS-102 UP) P637/R136/V85/M121 | KSC 39A 222:21:10:14Z 5:10:14 PM EDT (P) 5:10:14 PM EDT (A) Friday 23 8/10/01 (7)<br>LAUNCH WINDOW: 9M58S ISS WINDOW OPEN<br>EOM PLS: KSC TAL: ZZA TAL WX: MRN, BEN<br>SELECTED: RTLS: KSC 15 N/N TAL: MRN 20 N/N AOA: KSC 15 N/N PLS: EDW 22 N/N<br>TDEL: 0.05 -0.148/-0.11<br>MAX Q NAV: 723 715<br>SRB STG: 2:02.2 2:07<br>PERF: NOMINAL<br>2 ENG TAL (BEN): 2:27 2:21<br>NEG RETURN: 3:55 3:58<br>PTA (U/S 163): 4:35 4:36<br>SE OPS <sup>3</sup> : 5:25<br>PTM (U/S 163): 6:36 6:44<br>Continued... | KSC 15 (KSC 56) 234:18:22:59Z 2:22:59 PM EDT<br>Wednesday 13 8/22/01 (6)<br>DEORBIT BURN: 234:17:15:23Z<br>XRRANGE: 793 NM<br>ORBIT DIR: AR 10<br>AIM PT: NOMINAL<br>MLGTD: 1508 FT 234:18:22:59Z<br>VEL: 210 KGS 202 KEAS<br>HDOT: -3.2 FPS<br>TD NORM 195: 2256 FT<br>NLGTD: 4971 FT 234:18:23:10Z<br>VEL: 157 KGS 149 KEAS<br>HDOT: -6.9 FPS<br>DRAG CHUTE DEPLOY: KEAS 234:18:23:01Z<br>BRK INIT: 78 KGS<br>DRAG CHUTE JETTISON: 56 KGS 234:18:23:43Z<br>BRK DECEL FPS <sup>2</sup> : AVE 3.8 PK 4.9<br>WHEELS STOP: 234:18:24:05Z 11544 FT<br>ROLLOUT: 10036 FT 66 SEC<br>Continued... | 104/104/109%<br>PREDICTED: 100/104.5/104.5/72/104.5<br>ACTUAL: 100/104.5/104.5/72/104.5<br>1 = 2052 (4)<br>2 = 2044 (6)<br>3 = 2045 (6)<br>ALL BLOCK IIA SSME'S | BI-109<br>RSRM 81<br>ET-110<br>SLWT 15 | 51.60 (11)<br>DIRECT INSERTION<br>POST OMS-2: 125.9 X 84.8 NM | OI-28 (5) | CARGO: 33107 LBS<br>PAYLOAD CHARGEABLE: 29305 LBS<br>DEPLOYED: 9657 LBS<br>NON-DEPLOYED: 4654 LBS<br>MIDDECK: 475 LBS<br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1075685 LBS NON-DEPLOYED: 1511356 LBS CARGO TOTAL: 3298239 LBS<br>PERFORMANCE MARGINS (LBS): FPR: 3065 FUEL BIAS: 937 FINAL TDDP: 705 RECON: 631<br>PAYLOADS: PLB: ISS-7A.1 (MPLM, ICC crew rotation) Heat, GAS (2) RMS, ODS<br>MIDDECK: None<br>5 CRYO TK SETS 6 GN2 Tanks RMS 63<br>RMS used to install MPLM on Node 1 and berth in PLB, to install EAS on P6 truss, and EVA Support | <b>Brief Mission Summary:</b> The STS-105/7A.1 (11 <sup>th</sup> ISS mission) provided a new crew to the ISS, transfer of supplies and equipment via the second flight of the Leonardo MPLM. This flight completed the first round trip for Expedition rotation crews (EXP 2).<br>KSC W/D: OPF 79, VAB 8, PAD 31 = 118 days total.<br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 6/21/01 on 6/22/00<br>- Postponed launch date to 7/12/01<br>- Postponed launch date to NET 8/5/01 on 6/7/01<br>- Postponed launch date to NET 8/9/01 on 7/11/01<br>LAUNCH SCRUBS:<br>- Scrubbed the 8/9/01 launch attempt. The launch window was in two planes; however, at the L-2 day MMT, it was decided not to use Plane 2 for the first launch attempt on Thursday, August 9, 2001. Window opened at 221:21:32:47Z and closed at 221:21:42:46Z or 9M59S total window. With a Preferred Launch Time (PLT) of 221:21:37:46Z, the launch window was 5M00S. Launch attempt was scrubbed at L-25 minutes due to thunderstorms within 20nm, lightning strikes at 12 nm, and detached anvils over the Pad and SLF. All three TAL sites were GO. Weather Scrub. Launch set for Friday, August 10.<br>LAUNCH WINDOW:<br>- Launch window opened at 222:21:10:14Z and closed at 222:21:20:12Z, giving a total launch window of 9M58S. The PLT (Preferred Launch Time) of 222:21:15:13Z (In Plane Time) was selected, which gave a planned window of 4M59S. During the late count, thunderstorms were moving toward the launch site from the Southwest and forecast to be within 30 nm of the Pad and SLF at launch time. At L-27 minutes, the Ops Manager made the decision to increase the probability of launching by moving the Launch Time to the opening of the launch window (222:21:10:14Z), giving the ultimate launch window of 9M58S. Weather was observed GO at RTLS landing time for PLT and Window Open Time.<br>LAUNCH DELAYS: NONE<br>- Launch occurred On-Time at 222:21:10:14Z, Friday, August 10, 2001 at 5:10:14 PM EDT.<br>TAL WX:<br>- All three TAL sites were forecast and observed GO (Zaragoza (prime), Moron, and Ben Guerir). Moron was selected because it had the best weather (ZZA had potential for winds and rain).<br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set plus PE Operational High Q SUM/AUG, 52 nm MECO, and Del Psi.<br>FIRSTS/LASTS:<br>- First Shuttle round trip with Expedition rotation crews (Expedition 3 crew up, Expedition 2 crew down).<br>RENDEZVOUS #55:<br>Rendezvous and dock with ISS-PMA 2 Lab Forward Port<br>Continued... |

STS105-E-5067 (12 August 2001)  
--- Close-up view of Shuttle/ISS docking.





# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW<br>(7 UP/7 DOWN)<br><br>TITLE, NAMES<br>& EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE,<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br><br>AND<br>ET   | ORBIT   |  | FSW | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|--|---|--|--|--|---|--|-----|---|--|
| STS-105/<br>ISS 7A.1   |         | Continued...<br><br><u>M/S 4 DN/EXP 2 Flt Eng 2:</u><br>Susan J. Helms<br>(Flt 5 - STS-54, STS-64,<br>STS-78, STS-101,<br>STS-102 UP)<br>P638/R158/V108/F19<br><br><u>M/S 5 DN/EXP 2 CDR:</u><br>Yuri V. Usachev<br>(Flt 2 - STS-101)<br>(Russia)<br>(STS-102 UP)<br>P639/R256/V168/M223<br><br>SS EVA #68<br>EMU/TETHERED<br>EVA #61<br>SCHEDULED EVA #62<br>DURATION 6:16<br><br>SS EVA #69<br>EMU/TETHERED<br>EVA #62<br>SCHEDULED EVA #63<br>DURATION 5:29<br><br>MCC WHITE FCR (36)<br><br><u>FLIGHT DIRECTORS:</u><br>A/E/ O1 - J. P. Shannon<br>LD/O1 - P. F. Dye<br>O 2 - K. B. Beck<br>PLNG/O3 - B. P. Austin<br><br>ISS LD/O1 - M. J. Ferring<br>ISS O2 - R. E. La Brode<br>ISS P/O3 - J. M. Curry<br>MOD - N. W. Hale | Continued...<br><br><u>SE TAL (ZZA):</u><br>6:04 5:59<br><br><u>MECO CMD:</u><br>8:24.4 8:27<br><br><u>OMS-2:</u><br>38:34 38:34<br>96.4 96.2 | Continued...<br><br><u>WINDS:</u><br>3T 6L<br><u>OFFICIAL:</u><br>04007P11<br>SS: 6L 3T<br>PK: 10L 4T<br><br><u>DENS ALT:</u><br>1816 FT<br><br><u>FLT DURATION:</u><br>11:21:12.45<br><br><u>S/T:</u><br>943:12:45:47<br><br><u>OV-103:</u><br>241:22:40:35<br><br><u>DISTANCE:</u><br>4,912,390 sm | <br><b>STS105-E-5326 (17 August 2001) --- The STS-105 mission involved three crews, shown in U.S. Lab. EXP 3 crew (white shirts) front to back, Culbertson/RSA, Dezhurov/RSA, &amp; Tyurin/RSA; STS-105 crew (stripped shirts) front row, Forrester &amp; Barry, and back row, Horowitz and Sturckow. EXP 2 crew (red shirts) front to back, Usachev/RSA, Voss, &amp; Helms.</b> |  | <p>Continued...</p> <p><b>FLIGHT DURATION CHANGES:</b></p> <ul style="list-style-type: none"><li>- Total changes-one orbit weather extension. NEOM was to land at KSC on orbit 186 at approximately 12:46 PM EDT. EDW was not called up. At Tig-25 minutes, waved-off landing due to observed and forecast thunderstorms and rain showers within 20 nm of SLF. STA reported there was not-a-cloud-in-the-sky over Florida except for the rain cell that persisted at 1 or 2 miles south of the SLF, which caused the wave-off. Landed at KSC 15 on orbit 187 at 234:18:22:59Z, 2:2:59 PM EDT, on Wednesday, August 22, 2001.</li></ul> <p><b>EVENTS:</b></p> <ul style="list-style-type: none"><li>- ISS capture was at 1:21:31:27 MET, 224:18:41:41Z.</li><li>- ISS hard dock at PMA2 Lab Forward Port at 1:21:53:39Z, 224:19:03:53Z.</li><li>- First ISS hatch opening at 1:23:30 MET, 224:20:41:14Z.</li><li>- RMS grapple of the MPLM at 2:15:41:46 MET, 225:12:52:00Z.</li><li>- MPLM installed on Node 1 at 2:18:35:37 MET, 225:15:45:51Z.</li><li>- IELK time and Command Handover Time (ISS transfer from Exp 2 crew to Exp 3 crew and Cmd from Usachev to Culbertson) at 225:19:15Z.</li><li>- Exp 2 habitant time (Usachev=156:08:35, Voss=154:14:17, Helms=152:10:34). OV-105 crew ISS Visitor Time=7:19:47:44.</li><li>- EVA 1 Start time 228:13:58:14Z, 5:16:48:00, duration 6H16M.</li><li>- EAS installed on P6 Truss and Pip Pin in at 228:15:40:02Z, 5:18:29:47 MET.</li><li>- First Reboost maneuver started at 226:17:56:26Z, 3:20:48:12 MET, delta V 6.0 ft/sec, altitude increase 1.7 nm, orbit 218 by 208 nm.</li><li>- Second Reboost maneuver started at 229:12:12:27Z, 6:15:02:13 MET, delta V 6.4 ft/sec, altitude increase 1.8 nm, orbit 218.8 by 209.5 nm.</li><li>- EVA 2 started at 230:14:32Z, 7:16:32 MET, and ended at 230:20:01Z, duration 5M29S.</li><li>- SimpleSat deployed from Gas Can at 232:18:29:14Z, 9:21:19:00 MET.</li><li>- Total transferred to ISS 10651 lbs; 9657 lbs cargo (MPLM 6314, ICC 1549, MD 1794, H2O 10 CWC's with 993.8 lbs). Total transferred from ISS 3802 lbs (MPLM 2564, ICC 0, MD 1238). Net transfer from Shuttle to ISS=6849 lbs.</li><li>- Crew rotation, Exp 3 up and Exp 2 down. Delivered and installed EAS on P6 Truss and attached cables. Clamped MISSE to ISS Airlock handrails. Installed 11 handrails on U.S. Lab.</li><li>- Undocked at 232:14:51:37Z.</li><li>- ISS Visitor Time is 7:19:47:44. Exp 2 Crew ISS Flight Time 167:06:40:50 (New U.S. record). Exp 2 Crew ISS Habitant Times: Usachev 156:08:35:00 (ISS record), Voss 154:14:17:00, Helms 152:10:34:00 (Times based on Exp 2 to Exp 3 IELK transfer times).</li></ul> |  |     |   |  |
|  |         |   |   |   |  | <p>STS105-E-5265 --- Barry (left) and Forrester surround Early Ammonia Servicer (EAS), to be installed on P6 during EVA 1.</p> |   |  |     |   |  |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER   | CREW 7 UP/7DOWN<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET                                       | ORBIT INC HA/HP  | FSW          | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|---|--|--|--|---|---|--|--------------|--|--|
| STS-108/ISS UF-1<br>SEQ FLT #107<br>KSC-107<br>PAD: 39B-47<br>MLP-1<br>TWELFTH SHUTTLE FLIGHT TO ISS | OV-105 (Flight 17)<br>Endeavor<br>OMS PODS: LPO4-24 RPO1-31 FRC5-17 | CDR: Dominik L. Gorie (Flt 3 - STS-91, STS-99) P640/R242/V157/M211<br>PLT: Mark E. Kelly P641/R271/M237<br>M/S 1: Linda M. Godwin (Flt 4 - STS-37, STS-59, STS-76) P642/R122/V105/F13<br>M/S 2: Daniel M. Tani P643/R272/M238<br>M/S 3 UP/EXP 4 Flt Eng: Carl E. Walz (Flt 4 - STS-51, STS-65, STS-79) P644/R170/V106/M148<br>M/S 4 UP/EXP 4 Flt Eng: Daniel W. Bursch (Flt 4 - STS-51, STS-68, STS-77) P645/R169/V109/M147<br>M/S 5 UP/EXP 4 CDR: Yuri I. Onufrienko (Russia) P646/R273/M239<br>M/S 3 DN/EXP 3 CDR: Frank L. Culbertson, Jr. (Flt 3 - STS-38, STS-51, STS-105 UP) P647/R116/V95/M105<br>M/S 4 DN/EXP 3 SPLT: Vladimir N. Dezhurov (Russia) (Flt 2 - STS-71, STS-105 UP) P648/R195/V174/M170 | KSC 39B<br>339:22:19:28Z<br>5:19:28 PM EST (P)<br>5:19:28 PM EST (A)<br>Wednesday 12<br>12/5/01 (7)<br><br>LAUNCH WINDOW: 7M34S USING PLT (IN-PLANE TIME)<br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED: RTLS: KSC 33/N/N<br>TAL: ZZA 30/N/N<br>AOA: NOR 17/N/SF<br>PLS: EDW 22/N/N<br><br>TDEL: 0.03 -0.1568<br><br>MAX Q NAV: 714 708<br><br>SRB STG: 2:05 2:04<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN): 2:19 2:26<br><br>NEG RETURN: 3:48 3:53<br><br>PTA (U/S 154): 4:51 4:58<br><br>SE TAL (ZZA 104): 6:03 6:06<br><br>PTM (U/S 154): 6:20 6:20<br><br>SE PTM (U/S 736): 6:52 6:57<br><br>MECO CMD: 8:23.8 8:25.7<br><br>Continued... | KSC 15 (KSC 57)<br>351:17:55:12Z<br>11:55:12 AM EST<br><br>Monday 20<br>12/17/01 (13)<br><br>DEORBIT BURN: 351:16:48:13Z<br>XRRANGE: 26 NM<br>ORBIT DIR: AR 11<br>AIM PT: NOMINAL<br>MLGTD: 3024 FT<br>351:17:55:12Z<br>VEL: 198 KGS<br>201 KEAS<br>HDOT: -1.6 FPS<br><br>TD NORM 205: 2734 FT<br><br>NLGTD: 6901 FT<br>351:17:55:24Z<br>VEL: 143 KGS<br>146 KEAS<br>HDOT: -6.3 FPS<br><br>DRAG CHUTE DEPLOY: 191 KEAS<br>351:17:55:16Z<br>BRK INIT: 92 KGS<br>DRAG CHUTE JETTISON: 57 KGS<br>351:17:56:18Z<br>BRK DECEL FPS <sup>2</sup> : AVE 4.2 PK 6.9<br><br>WHEELS STOP: 351:17:56:18Z<br>11965 FT<br><br>ROLLOUT: 8941 FT<br>66 SEC<br><br>WINDS: 6H, 2L<br>OFFICIAL: 14006PT3<br>SS: 6H, 2L<br>PK: 13H, 2L<br><br>Continued... | 104/104/<br>109%<br><br>PREDICTED: 100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL: 100/104.5/<br>93/72/<br>104.5<br><br>1 = 2049 (6)<br>2 = 2043 (7)<br>3 = 2050 (2)<br><br>ENGINE 2050<br>IS BLOCK II<br>ENGINE.<br>OTHER TWO<br>BLOCK IIA<br>ENGINES. | BI-110<br><br>RSRM<br>82<br><br>ET-111<br><br>SLWT 16 | 51.60<br>(12)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>124.2 X 121.6<br>NM | OI-28<br>(6) | CARGO: 38177 LBS<br><br>PAYLOAD CHARGEABLE: 31393 LBS<br><br>DEPLOYED: 6454 LBS<br><br>NON-DEPLOYED: 8635 LBS<br><br>MIDDECK: 690 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1082139 LBS<br>NON-DEPLOYED: 1520683 LBS<br><br>CARGO TOTAL: 3336416 LBS<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 3065<br>FUEL BIAS: 937<br>FINAL TDDP: 2881<br>RECON: 1182<br><br>PAYLOADS: PLB: ISS UF-1 (MPLM, LMC)<br>MACH-1, SEM (1), GAS (5), RMS, ODS, Crew Transfer<br><br>MIDDECK: ADF CBTM SIMPLEX ISS UF-1<br><br>5 CRYO TK SETS<br>6 GN <sub>2</sub> TANKS<br><br>RMS 64<br><br>RMS used for ISS MPLM deploy and retrieve and EVA support | <b>Brief Mission Summary:</b> The STS-108/UF 1 (12 <sup>th</sup> ISS mission) provided a new crew to the ISS, transfer of supplies and equipment via the Raffaello MPLM, and an EVA to install thermal blankets at the bases of the solar panels. Launch was scrubbed twice; first due to debris in ISS docking port from Progress 6 soft dock, and second due to RTLS and Range weather.<br><br>KSC W/D: OPF 142, VAB 6, PAD 34 = 182 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 10/4/01 on 9/21/00<br>- Postponed launch date to NET 11/1/01<br>- Postponed launch date to 11/29/01<br><br>LAUNCH SCRUBS:<br>- Scrubbed Thursday 11/29/01 EDT (11/30/01 GMT) Launch at ET Tanking MMT at L-9.5 Hours due to an ISS problem. Progress 6 had Soft Docked with SM Aft Port; however, did not achieve Hard Dock. Suspect debris within the docking interface. U.S. ISS Mgmt wanted to work problem and it was decided to go into a 24-hour scrub turnaround, then 48-hr scrub turnaround. Initially IP Russia was GO. U.S. ISS management wanted to scrub to work problem. Then IP Russia announced at ISS MMT on 11/30/01 that they planned an EVA on 12/3/01 to clear debris in docking mechanism. SSP MMT on 11/30/01 set launch for 12/4/01 to allow review of results of EVA. IP Russia EVA crew removed damaged seal from previous Progress enabling Progress 6 to Hard Dock. ISS Technical Scrub (new category of scrub).<br>- Scrubbed Tuesday 12/4/01 launch due to RTLS and Range weather (light precipitation and low ceiling). Low clouds moved into launch area from the Northeast bringing dynamic weather conditions particularly in last hour before launch. RTLS runway selection alternated between 33 and 15. Light rain was reported only by the STA as it was not visible on radar or by SLF Observer. Counted down to T-5 minutes and held while evaluating the observed and forecast weather. Scrubbed at 338:22:44:43Z (Preferred Launch Time was 22:45:08Z) while holding at T-5 minutes based on STA observations of precipitation and cloud cover and a late update SMG forecast of broken clouds over SLF runway. RTLS and Range WX Scrub. Went into a 24 hour scrub turnaround. All 3 TAL sites were GO.<br><br>LAUNCH WINDOW:<br>- Window opened at 339:22:15:35Z and closed at 339:22:27:02Z giving a total window of 11:37 in two panes with a 19-second gap between panes. Preferred Launch Time (PLT) in-plane time for pane 1 was 339:22:19:28Z giving a window of 7M34S.<br><br>LAUNCH DELAYS: None<br>- Launch occurred On-Time at 339:22:19:27.951Z, 5:19:28 PM EST, on Wednesday, 12/5/01.<br><br>TAL WX:<br>- All three TAL sites (ZZA, MRN, and BEN) were GO. Zaragoza was prime but it was a low energy day there, so Moron was selected.<br>- MRN was 2-Eng TAL Call<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set plus PE Operational High Q, OMS Assist is 4000 lbs, 52 nm MECO, and Del Psi.<br><br>Continued... |

ISS003-E-8272 (7 December 2001) ---  
Endeavour approaches ISS with ISS P/L  
ISS UF-1 (MPLM, LMC)





## Page 2-143 - STS-108/UF-1

| FLT NO.           | ORBITER | CREW 7 UP/7 DOWN<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES                                   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG | SRB RSRM AND ET | ORBIT INC HA/HP | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|-------------------|---------|--|---|--|-------------------------|-----------------|-----------------|-----|--|--|
| STS-108/ ISS UF-1 |         | Continued...<br><br>M/S 5 DN/EXP 3 Flt Eng: Mikail Tyurin (Russia) (STS-105 UP) P649/R270/M236<br><br>SS EVA #70 EMU/TETHERED EVA #63 SCHEDULED EVA #64 DURATION 4:11<br><br>MCC WHITE FCR (37)<br><br>FLIGHT DIRECTORS: A/E - L. E. Cain Shuttle LD/O 1 - N. W. Hale Shuttle O 2 - P. S. Hill Shuttle Plng - C. A. Koerner<br><br>ISS LD/O 1 - S. P. Davis ISS O 2 - R. E. Castle ISS PLNG - J. A. McCullough MOD - J. M. Hefflin | Continued...<br><br>VI: 25822 25823<br><br>OMS-2: 37:42 37:47 164 FPS 164 FPS 1:48 1:48 | Continued...<br><br>DENS ALT: 1607 FT<br><br>FLT DURATION: 11:19:35:44<br><br>S/T: 955:08:21:31<br><br>OV-105 178:22:49:47<br><br>DISTANCE: 4,817,649 sm |                         |                 |                 |     |  | <p>Continued...</p> <p><b>SIGNIFICANT ANOMALIES:</b></p> <ul style="list-style-type: none"> <li>- GSE Gaseous Hydrogen (GH<sub>2</sub>) Vent Arm did not latch-back and the GUCP rebounded beyond FSS. GH<sub>2</sub> Vent Arm contacted side of support structure (Constraint to next flight)</li> <li>- RCS Thruster R4U Failed-Off and was auto deselected</li> <li>- RCS Thruster F3F Failed-Off and was auto deselected</li> <li>- Loud white noise was heard on A/G 2 after SSOR 1 was tied to Orbiter Audio Bus</li> <li>- IMU 2 Platform fail and redundant rate BITE</li> <li>- Left RCS Oxidizer B Regulator Low Flow-Pressure</li> <li>- RCS Secondary Hi-Load Not Controlling</li> <li>- Tear or hole on drag chute main canopy during dis-reef, 5 ribbons torn and 2 stretched</li> <li>- Failed Ties Between Sabot and Pilot Chute Bag</li> </ul> <p><b>FLIGHT DURATION CHANGES:</b></p> <ul style="list-style-type: none"> <li>- Extended flight one docked day to allow time for additional ISS tasks. Initially planned (before extension) to land at KSC on orbit 170. After one day extension, planned landing at KSC on orbit 186. Endeavour landed at KSC on runway 15 on orbit 186 at 351:17:55:11Z, 122:55:11 PM EST on Monday, December 17, 2002.</li> </ul> <p><b>FLIGHT DURATION CHANGES:</b></p> <ul style="list-style-type: none"> <li>- SMG Weather forecast for KSC on Tig orbit 185/Landing orbit 186 was forecast NO GO due to ceiling (3000 broken and 6500 broken). However, STA was reporting an observed GO and several positive factors provided the FD confidence to give a GO for landing on orbit 186. A Flight Rule waiver was approved post flight.</li> </ul> <p><b>FIRSTS/LASTS:</b></p> <ul style="list-style-type: none"> <li>- First flight of Block II SSME (S/N 2050) in position 3.</li> </ul> <p><b>EVENTS:</b></p> <ul style="list-style-type: none"> <li>- MC4 maneuver at 341:16:52Z, 01:18:32 MET, orbit 195.8 by 209.7 nm</li> <li>- ODS captured ISS at 341:20:03:25Z, 1:21:43:58 MET</li> <li>- MPLM grappled by RMS at 342:16:14Z, 2:17:54 MET, unberthed at 342:17:00Z, 2:18:40 MET and installed on NODE, RMS ungrappled MPLM at 342:18:09:20Z, 2:19:49 MET</li> <li>- Reboost #1 Start at 343:15:11:40Z, 3:16:52:12 MET, Delta V = 6.3 FPS, altitude increase 1.9 nm, resulting orbit 210.6 by 199.0 nm</li> <li>- EVA 1 Start at 344:19:34Z, 4:21:14 MET, duration of 4 hours 11 minutes. Installed MLI blankets on Beta Gimbal Assembly on solar arrays 4B and 2B. Removed SASA blanket and pre-positioned Circuit Interrupt Devices (CID's).</li> <li>- Reboost #2 Start at 345:16:19:40Z, 5:18:00:12 MET, Delta V = 6.5 FPS, altitude increase 1.8 nm, resulting orbit 211.3 by 201.2 nm</li> <li>- Reboost #3 Start at 346:15:22:32Z, 6:17:03:04 MET, Delta V = 14.1 FPS, altitude increase of 4.0 nm, resulting orbit 213.4 by 206.9 nm</li> <li>- Reboost #4 was performed for collision avoidance. Started at 349:14:55:40Z, 9:16:36:13 MET, Delta V = 2.1 FPS, altitude increase of 0.6 nm, resulting orbit 213.8 by 206.3 nm</li> <li>- Undocking: 349:17:28:35Z, 9:19:08 MET</li> <li>- ISS Separation burn at 349:17:28:35Z, 9:19:09:08 MET</li> <li>- Total water transferred to ISS was 299 lbm (210.3 lbm in 3 CWC's plus 88.7 lbm in 4 PWR's).</li> <li>- Total transfers from Shuttle to ISS was 6244 lbs (from MPLM 5249 lbs and Middeck 995 lbs), total transfer from ISS was 4156 lbs (in MPLM 3007 lbs and to Middeck 1149 lbs).</li> <li>- Endeavour/ISS Visitor Time is 7:21:25:11.</li> <li>- Expedition 4 Crew Up, Expedition 3 Crew Down.</li> <li>- Expedition 3 Crew ISS Habitant Time - 117:02:57:00.</li> <li>- Expedition 3 Crew Flight Time - 128:20:44:58</li> <li>- Culbertson Total Flight Time - 143:14:50:31</li> <li>- Official transfer time from Expedition 3 to Expedition 4 crew was 342:22:12:00Z.</li> </ul> <p><b>RENDZVOUS #56:</b></p> <ul style="list-style-type: none"> <li>- Rendezvous and dock with ISS to PMA2 Lab Fwd Port. Expedition 4 Crew Up, Expedition 3 Crew Down.</li> </ul> |
|                   |         |  |   |  |                         |                 |                 |     |  | <p>STS-108-E-5390 --- Crews: Exp 4 (green shirts), STS-108 (blue shirts), &amp; Exp 3 (white shirts) in ISS Destiny Lab. Exp 4 from front to back, CDR Onufrienko, Bursch/FE, &amp; Walz/FE. STS-108 back row, Godwin/MS, PLT Kelly, CDR Gorie, &amp; Tani/MS. Exp 3 crew from front to back, CDR Culbertson, Dezhurov/FE &amp; Tyurin/FE.</p> <p>ABOVE: STS108-328-007 (16 December 2001) --- A small satellite called STARSHINE 2 is deployed for 30,000 students studying density of Earth's upper atmosphere</p> <p>BELOW: STS108-E-5359 (10 December 2001) --- Godwin &amp; Tani install insulation blankets on ISS solar array rotation mechanisms.</p>  |



# SPACE SHUTTLE MISSIONS SUMMARY




Page 2-144 - STS-109

| FLT NO.   | ORBITER  | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT  |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|--|--|--|--|---|--|---|--|--|---|
| STS-109<br><br>SEQ<br>FLT # 108<br><br>KSC-108<br><br>PAD<br>39A-61<br><br>MLP-2<br><br>Fourth HST Service Flight | OV-102 (Flight 27)<br><br>Columbia<br><br>OMS PODS:<br>LPO5-16<br>RPO5-15<br>FRC2-27 | CDR:<br>Scott D. Altman<br>(Flt 3 - STS-90, STS-106)<br>P650/R237/V161/M207<br><br>PLT:<br>Duane Carey<br>P651/R274/M240<br><br>M/S 1/EV1:<br>John Grunsfeld<br>(Flt 4 - STS-67, STS-81, STS-103)<br>P652/R191/V133/M167<br><br>M/S 2:<br>Nancy Currie<br>(Flt 4 - STS-57, STS-81, STS-103)<br>P653/R165/V120/F21<br><br>M/S 3/EV2:<br>Richard Linnehan<br>(Flt 3 - STS-78, STS-90)<br>P654/R214/V150/M187<br><br>M/S 4/EV3:<br>James Newman<br>(Flt 4 - STS-51, STS-69, STS-88)<br>P655/R168/V122/M146<br><br>M/S 5/EV4:<br>Michael Massimino<br>P656/R275/M241<br><br><br>SS EVA #71<br>EMU/TETHERED<br>EVA #64<br>SCHEDULED EVA #65<br>DURATION 7:01<br><br>SS EVA #72<br>EMU/TETHERED<br>EVA #65<br>SCHEDULED EVA #66<br>DURATION 7:16<br><br>Continued... | KSC 39A<br>60:11:22:01:99Z<br>6:22:02 AM EST (P)<br>6:22:02 AM EST (A)<br>Friday 24<br>3/1/02 (8)<br><br>LAUNCH WINDOW:<br>HST Planar/Phase Window 61M51S<br><br>EOM PLS: KSC<br>TAL: BEN<br>TAL WX: NONE<br><br>SELECTED:<br>RTLS: KSC 15/C/I/N<br>TAL: BEN 36/N/N<br>AOA: EDW 22/N/N<br>PLS: EDW 04/C/I/N<br><br>TDEL:<br>-0.03 -0.26/-0.023<br><br>MAX Q NAV:<br>693 ??? 754<br><br>SRB STG:<br>2:06 2:07<br><br>PERF: NOMINAL<br><br>2 ENG TAL (BEN):<br>2:17 2:16<br><br>NEG RETURN:<br>3:55 3:59<br><br>PTA (U/S 530):<br>3:50 3:55<br><br>PTM (U/S 500):<br>5:06 5:08<br><br>SE TAL (BYD):<br>5:50 5:50<br><br>MECO CMD:<br>8:21.5 8:23.9<br><br>Continued... | KSC 33 (KSC 58)<br>71:09:31:53Z<br>4:31:53 AM EST<br><br>Tuesday 20<br>3/12/02 (9)<br><br>DEORBIT BURN:<br>71:08:22:39Z<br><br>X RANGE: 268 NM<br><br>ORBIT DIR: DL 48<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3433 FT<br>71:09:31:53Z<br>VEL: 196 KGS<br>186 KEAS<br>HDOT: -2.7 FPS<br><br>TD NORM 195:<br>2993 FT<br><br>NLGTD: 6286 FT<br>71:09:32:01Z<br>VEL: 156 KGS<br>149 KEAS<br>HDOT: -5.6 FPS<br><br>DRAG CHUTE<br>DEPLOY: 181 KEAS<br>71:09:31:55Z<br><br>BRK INIT: 66 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>63 KGS<br>71:09:32:37Z<br><br>BRK DECEL (FPS) <sup>2</sup> :<br>AVE 3.7 PK 7.2<br><br>WHEELS STOP:<br>71:09:33:05Z<br>13552 FT<br><br>ROLLOUT:<br>10119 FT<br>72 SEC<br><br>WINDS:T5, R2<br>OFFICIAL:<br>13005P08<br>SS: T5, R2<br>PK: T8, R3<br><br>Continued... | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>101/72/<br>104.5<br><br>1 = 2056 (2)<br>2 = 2053 (4)<br>3 = 2047 (7)<br><br>ALL SSME's<br>BLOCK IIA | BI-111<br><br>RSRM<br>83<br><br>ET-112<br><br>SLWT-17<br><br>ET<br>IMPACT<br>1:28:35<br>MET<br><br>LAT:<br>16.3°N<br><br>LONG:<br>143.6°W | 28.45<br>(50)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>310.5 x 105.0<br>NM<br><br>DEORBIT:<br>312.6 x 259 NM<br><br>VELOCITY:<br>26082 FPS<br><br>ENTRY<br>RANGE:<br>4274 NM | OI 28<br>(7)<br><br>CARGO:<br>27564 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>20144 LBS<br><br>DEPLOYED:<br>8256 LBS<br><br>NON-DEPLOYED:<br>10672 LBS<br><br>MIDDECK:<br>1216 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1090395 LBS<br>NON-DEPLOYED:<br>1532571 LBS<br>CARGO TOTAL:<br>3363980 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3065<br>FUEL BIAS: 937<br>FINAL TDDP: 3309<br>RECON: 4170<br><br>PAYLOADS:<br>PLB:<br>HST<br>Service Mission 3B<br>RMS<br><br>MIDDECK:<br>NONE<br><br>5 CRYO TK SETS<br>5 GN2 TANKS<br><br>RMS 65<br><br>RMS USED FOR:<br>HST GRAPPLE,<br>BERTH, SERVICE,<br>AND RELEASE. | <b>Brief Mission Summary:</b> The STS-109 mission was the 4 <sup>th</sup> Servicing Mission to the Hubble Space Telescope to rejuvenate the World's Greatest Observatory. During five EVA's the crew replaced the Reaction Wheel Assembly, the solar arrays, the Power Control Unit (down since 1999) and installed a new scientific instrument, the Advanced Camera for Surveys (ACS). The ACS is able to survey a field of the cosmos twice as large as previous instruments, with ten times the resolution and four times the speed.<br><br>KSC W/D: OPF 253, VAB 8, PAD 32 = 293 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline launch date of 11/1/01 on 9/21/00<br>- Postponed launch date to NET 11/19/01 on 5/4/01<br>- Postponed launch date to 1/17/02 on 5/10/01<br>- Postponed launch date to 2/14/02 on 10/4/01<br>- On 12/21/01, postponed launch date to NET 2/21/02 to allow manifest of new RWA (new HST problem) and train EVA crew.<br>- On 1/10/02, postponed launch date to 2/28/02, had to prepare and ship another RWA to KSC. First RWA was faulty.<br><br>LAUNCH SCRUBS:<br>- 2/28/02 Launch was scrubbed at approximately L-16 hours due to forecast of cold weather at pad at LCC limits. Forecast was for 38 deg, 73 percent humidity, winds 7 to 10 knots. This forecast is one degree above the minimum temperature, and MMT decided to scrub and reschedule launch for 3/1/02. Observation S at launch time were 28 deg, RH 71 percent, winds 7 to 10 knots. Wx scrub #36.<br><br>LAUNCH WINDOW:<br>- Window was in 2 panes: Pane 1 opened at 60:11:22:02Z and closed at 60:11:27:23Z (5M21S window), pane 2 opened at 60:11:27:33Z and closed at 60:12:23:53Z (56M20S window), and combined panes 1 & 2 yielded a window of 61M51S with a cutout from 11:23:20 to 11:24:20.<br><br>LAUNCH DELAYS: NONE<br>- Launched On-Time at 60:11:22:02Z, 6:22:02 AM EST, on March 1, 2002.<br><br>TAL WX:<br>- Ben Guerir was the only TAL site available. Ben Guerir was forecast and observed GO.<br><br>SHUTTLE NIGHT LAUNCH #27<br><br>RENDEZVOUS #57:<br>Rendezvous and berth HST, performed service operations, and released HST.<br><br>Continued... |  |   |





Intro\_im2\_smACS.jpg --- in the Clean Room at GSFC two men in "bunny suits" stand near the new ACS to be installed on HST.

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET | ORBIT |  | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|---|---|---|--|--------------------------|-------|--|-----|--|--|
| STS-109<br><br>Continued...  |         | Continued...<br><br>SS EVA #73<br>EMU/TETHERED<br>EVA #66<br>SCHEDULED EVA #67<br>DURATION 6:48<br><br>SS EVA #74<br>EMU/TETHERED<br>EVA #67<br>SCHEDULED EVA #68<br>DURATION 7:30<br><br>SS EVA #75<br>EMU/TETHERED<br>EVA #68<br>SCHEDULED EVA #69<br>DURATION 7:20 | Continued...<br><br>VI:<br>26114      26113<br><br>OMS-2:<br>44:00      43:57<br>134 FPS    134 FPS<br>1:27      1:27 | Continued...<br><br>DENS ALT:<br>326 FT<br><br>FLT DURATION:<br>10:22:09:51<br><br>S/T:<br>966:06:31:22<br><br>OV-102:<br>284:19:19:08<br><br>DISTANCE:<br>3,941,705 sm |    |                          |       |  |     | Continued...<br><br><b>PERFORMANCE ENHANCEMENTS:</b><br>- Standard Set Plus PE Operational High Q, WIN/FEB<br><br><b>SHUTTLE NIGHT LANDING #19</b><br><br><b>KSC NIGHT LANDING #14</b><br><br><b>FLIGHT DURATION CHANGES: NONE</b><br>- Planned landing at KSC on orbit 166. Landed at KSC Runway 33 on orbit 166, MLGTD at 71:09:31:53Z on Tuesday, March 12, 2002.<br><br><b>EVENTS:</b><br>- OMS-2 Start at 60:16:43:49Z, 13.8 duration, Delta V 10.3 ft/sec, resultant orbit 105.0 by 310.5 nm.<br>- NH maneuver (OMS-4) at 62:04:07:30Z, 207 seconds duration, Delta V 326.6 ft/sec, resultant orbit 302.2 by 309.2 nm. MC-4 at 62:08:23:29Z, resultant orbit 303.4 by 314.9 nm.<br>- HST capture by RMS at 62:09:31:21Z, and HST berth on FSS in PLB at 62:10:31:Z. 1:22:09:19 MET.<br>- EVA 1 Start at 63:06:37Z, 2:19:15 MET, End at 63:13:38Z, duration 7H01M. Replaced old SA with -V2 Solar Array 3 and diode box.<br>- EVA 2 Start at 64:06:41Z, 3:19:19 MET, End at 64:13:57Z, duration 7H16M. Replaced old SA with +V2 Solar Array 3 and diode box. Preplaced Reaction Wheel Assembly. Installed NOBL in Bay 6 and two doorstep extensions (one on -V2 side and one on +V2 side.)<br>- EVA 3 Start 2 hrs late at 65:08:28Z, 04:21:06 MET (EMU 1 got water in suit), hence had to resize EMU 3 for use by EV1. EVA duration 6H48M. Powered down HST and replaced PCU (Power Control Unit).<br>- EVA 4 Start at 66:09:00Z, 5:21:38 MET, duration 7H30M. Replaced FOC (Faint Object Camera) with new ACS (Advanced Camera for Surveys), installed Electronics Support Module and PCU clean up tasks.<br>- EVA 5 Start at 67:08:46Z, 6:21:24 MET. Installed NICMOS Camera and cryogenic cooler, duration 7:20.<br>- HST Reboost started at 67:17:18:04Z, 7:05:56:02 MET, Delta V 11.8 fps, altitude increase 3.6 nm, orbit of 314.7 by 310.6 nm.<br>- HST unberthed from Orbiter at 68:08:34Z, 7:21:12 MET and released at 68:10:04Z, 7:22:42 MET.<br>- Orbit Adjust maneuver at 70:10:07:32Z, 48.3 seconds, Delta V 11.6 fps, orbit 259 by 312.5 nm.<br>- Last flight of Block IIA Engines. |  |
| MCC WHITE FCR (38)<br><br>FLIGHT DIRECTORS:<br>LD/O 1 - B. P. Austin<br>O 2 - A. J. Ceccacci<br>PLNG - J. M. Hanley<br>A/E - J. P. Shannon<br>MOD - N. W. Hale |         |   |   |   | STS109-E-6032 --- Crew on middeck. From left (front row): Currie/MS, CDR Altman, & PLT Carey. From the left (back row): Grunsfeld/PLC, Linnehan/MS, Newman/MS, & Massimino/MS.   |                          |       |  |     |  |  |
|   |         |   |   |   |   |                          |       |  |     |  |  |
| STS109-713-014 (8 March 2002) --- Grunsfeld/MS (right) and Linnehan/MS during 5 <sup>th</sup> EVA completing HST upgrades.                                     |         |   |   |   | <b>SIGNIFICANT ANOMALIES:</b><br>- Freon® Loop 1 Aft Coldplate Flow Blockage<br>- Loss of EV1 Suit data during EVA<br>- Starboard Slidewire Slider Anomaly<br>- Inner Airlock "A" Hatch locking device difficult to actuate<br>- APU 3 Drain Line Pressure Decay<br>- MPS LH2 4-Inch Recirculation Disconnect Slow to Close<br>- Forward THC -X Contact Lost During One Burn<br>- FES Accumulator/Hi-Load Feedline B Heater System 2 Failure<br>- Primary RCS Thruster R3R Failed Off<br>- Water leaking from EMU 1 PLSS |                          |       |  |     |  |  |
|  |         |   |   |   |  |                          |       |  |     |  |  |



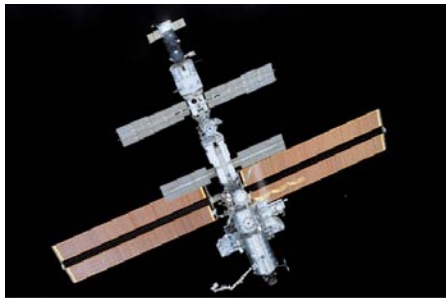


# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER               | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS                            | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.                                     | SRB<br>RSRM<br>AND<br>ET   | ORBIT         |                     | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|-----------------------|--|--|---|---|--|---------------|---------------------|--------------|---|--|
| STS-110/<br>ISS 8A  | OV-104<br>(Flight 25) | CDR:<br>Michael J. Bloomfield<br>(Flt 3 - STS-86, STS-97)<br>P657/R227/V165/M198 | KSC 39B<br>98:20:44:19Z<br>4:39:31 PM EDT (P)<br>4:44:19 PM EDT (A)<br>Monday (12)<br>4/8/02 (15)            | KSC 33 (KSC 59)<br>109:16:26:58Z<br>12:26:58 PM EDT<br><br>Friday 12<br>4/19/02 (11)                | 104/104/<br>109%<br><br>PREDICTED:<br>100/100/100/<br>67/104<br><br>ACTUAL:<br>100/100/100/<br>72/104 | BI-112<br><br>RSRM<br>85<br><br>ET-114<br><br>SLWT-18                        | 51.60<br>(13) | DIRECT<br>INSERTION | OI-29<br>(1) | CARGO:<br>35849 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>28379 LBS<br><br>DEPLOYED:<br>30600 LBS<br><br>NON-DEPLOYED:<br>0 LBS<br><br>MIDDECK:<br>757 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1122264 LBS<br>NON-DEPLOYED:<br>1533328 LBS<br>CARGO TOTAL:<br>3399829 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3065<br>FUEL BIAS: 937<br>FINAL TDDP: 1256<br>RECON: 2670<br><br>PAYLOADS:<br>PLB:<br>ISS 8A<br>S0 Truss and ITS<br>RMS, ODS<br><br>MIDDECK:<br>ISS 8A<br>Simplex<br>RAMBO<br><br>5 CRYO TK SETS<br>6 GN2 TANKS<br>RMS 66<br><br>RMS USED TO<br>MATE S0 TRUSS<br>AND EVA<br>SUPPORT | <b>Brief Mission Summary:</b> The STS-110/8A (13th mission to ISS) was the most complex ISS assembly flight to date with four EVA's and extensive use of Shuttle and ISS robotic arms. The EVA included successful beam assemblies, bolting of girders, and installing work lights and electrical connections. The ISS Canadarm2 transferred the 13.5 ton, 43-foot long S0 Truss (ISS backbone) from Shuttle payload bay for installation on U.S. Lab, Destiny. Also, the first railcar was operated on the new truss, paving the way for eventual transportation for the Canadarm2 along the length of the ISS.<br><br>KSC W/D: OPF 132, VAB 6, PAD 28 = 166 days total.<br><br>LAUNCH POSTPONEMENTS:<br>-Baselined launch date of 1/17/02 on 11/15/00.<br>-Postponed launch date to 2/28/02 on 5/4/01 and Postponed launch date to 3/21/02 on 10/4/01.<br>-Postponed launch date to 4/4/02 on 1/10/02 due to ground processing delays requiring OMS Pod removal.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 4/4/02 Launch at approximately L-8 hours, during ET Fill operations, due to a Hydrogen leak in the MLP 3 Hydrogen Vent Line which is fed by Orbiter Hi-Point Bleed line. The leak was found to be from a 1/8 in wide crack in a weld location in the 16-inch double walled aluminum line. Weld is more than 20 years old. Decision was made to repair using a clam-shell technique. New launch date was set for Monday, 4/8/02. Line was repaired using a two-piece clam-shell that was welded to the 16-inch outer line.<br><br>LAUNCH WINDOW:<br>- The Launch Window opened at 98:20:34:32Z and closed at 98:20:44:30Z for a total window of 9M58S. Using a Preferred Launch Time (In-Plane Time) of 98:20:39:31Z, the Launch Window was 4M59S.<br><br>LAUNCH DELAYS:<br>- Day-of-Launch Delay was 4M48S. LPS system detected consecutive sync errors in all three Stand-by PCM FEP'S (OI, GPC, PLD). The count was held at T-5 Min for 4M48S to execute Front End Processor resynchronization procedure which was successfully completed. Came out of the T- 5 Min hold, and picked up the count at 98:20:39:19Z (4:39:19 PM EDT) with 5M11S remaining to Launch Window closure. Launch occurred at 98:20:44:19Z, 4:44:19 PM EDT, on Monday, April 8, 2002. Only 11 seconds remained in the Launch Window at Liftoff.<br><br>TAL WX:<br>- Zaragoza (Prime and Selected) was Forecast and Observed GO. Moron was Forecast and Observed NO GO for Showers within 20 nm. Ben Guerir was Forecast GO but Observed NO GO for precipitation within 20 nm.<br><br>PERFORMANCE ENHANCEMENTS:<br>- Standard Set plus: (1) PE Operational High Q TRN/APR, (2). OMS Assist, (3) 52 NM MECO, (4) Del Psi |
| SEQ<br>FLT #109   | Atlantis              | OMS PODS:<br>LPO3-29<br>RPO4-25<br>FRC4-25                                       | PLT:<br>Stephen N. Frick<br>P658/R276/M242   | LAUNCH WINDOW:<br>4M59S PLT (In-Plane Time) with ISS  | DEORBIT BURN:<br>109:15:18:59Z<br><br>X RANGE: 73 NM<br><br>ORBIT DIR: AL 30<br><br>AIM PT: NOMINAL   | ET<br>IMPACT<br>1:14:19<br>MET<br><br>LAT:<br><br>35.8°S<br>LONG:<br>158.8°W |               |                     |              |   |  |
| KSC-109   |                       |  | M/S 2:<br>Ellen Ochoa<br>(Flt 4 - STS-56, STS-66, STS-96)<br>P660/R180/V113/F20                              | DEORBIT BURN:<br>109:15:18:59Z<br><br>X RANGE: 73 NM<br><br>ORBIT DIR: AL 30<br><br>AIM PT: NOMINAL | 1 = 2048 (4)<br>2 = 2051 (3)<br>3 = 2045 (6)  |  |               |                     |              |   |  |
| PAD<br>39B-48   |                       |  | M/S 3/EV4:<br>Lee M. E. Morin<br>P661/R278/M244  | DEORBIT BURN:<br>109:15:18:59Z<br><br>X RANGE: 73 NM<br><br>ORBIT DIR: AL 30<br><br>AIM PT: NOMINAL | 1 = 2048 (4)<br>2 = 2051 (3)<br>3 = 2045 (6)  |  |               |                     |              |   |  |
| MLP-3   |                       |  | M/S 4/EV3:<br>Jerry L. Ross<br>(Flt 7 - STS 61-B, STS-27, STS-37, STS-55, STS-74 STS-88)<br>P662/R89/V38/M80 | DEORBIT BURN:<br>109:15:18:59Z<br><br>X RANGE: 73 NM<br><br>ORBIT DIR: AL 30<br><br>AIM PT: NOMINAL | 1 = 2048 (4)<br>2 = 2051 (3)<br>3 = 2045 (6)  |  |               |                     |              |   |  |
| THIRTEENTH<br>SHUTTLE<br>FLIGHT TO<br>ISS   |                       |  | M/S 5/EV1:<br>Steven L. Smith<br>(Flt 4 - STS-68, STS-82, STS-103)<br>P663/R184/V137/M161                    | DEORBIT BURN:<br>109:15:18:59Z<br><br>X RANGE: 73 NM<br><br>ORBIT DIR: AL 30<br><br>AIM PT: NOMINAL | 1 = 2048 (4)<br>2 = 2051 (3)<br>3 = 2045 (6)  |  |               |                     |              |   |  |
|   |                       |  |  |   |   |  |               |                     |              |   |  |
|    |                       |  |  |   |   |  |               |                     |              |   |  |
| Continued..   |                       |  | Continued...   |   |   |  |               |                     |              |   |  |
| STS110-341-002 (11 April 2002) --- Canadarm2, operated by Ochoa & Bursch, moves S0 truss from Atlantis to temp location on ISS Destiny Lab. |                       |  |  |   |   |  |               |                     |              |   |  |





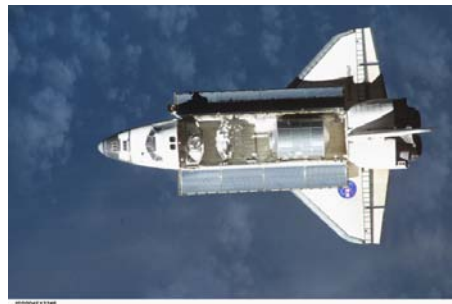
# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N.                       | SRB RSRM<br><br>AND ET   | ORBIT<br><br>INC<br><br>HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|---------|---|---|--|--|--|-------------------------------|--|-----|--|---|
| STS-110/<br>ISS 8A<br><br>Continued...   |         | Continued...<br><br>SS EVA 76<br>DOCKED QUEST EVA 2<br>SCHEDULED EVA 70<br>EMU/TETHERED EVA 69<br>DURATION 7:48<br><br>SS EVA 77<br>DOCKED QUEST EVA 3<br>SCHEDULED EVA 71<br>EMU/TETHERED EVA 70<br>DURATION 7:30<br><br>SS EVA 78<br>DOCKED QUEST EVA 4<br>SCHEDULED EVA 72<br>EMU/TETHERED EVA 71<br>DURATION 6:27<br><br>SS EVA 79<br>DOCKED QUEST EVA 5<br>SCHEDULED EVA 73<br>EMU/TETHERED EVA 72<br>DURATION 6:37<br><br>MCC WHITE FCR (39)<br><br>FLIGHT DIRECTORS:<br>Flt & ISS Ld/O2 - R. E. Castle<br>ISS O 1 - A. F. Algate<br>ISS PLNG - N. D. Knight<br>STS LD/O 1 - J. M. Hanley<br>O 2 - P. F. Dye<br>O 3/PLNG - J. S. Stich<br>A/E - L. E. Cain<br>MOD - J. M. Hefflin | Continued...<br><br>VI:<br>25821                      25822<br><br>OMS-2:<br>96 FPS                      96 FPS<br>38:38                      38:45 | Continued...<br><br>DENS ALT:<br>1260 FT<br><br>FLT DURATION:<br>10:19:42:39<br><br>S/T:<br>977:02:14:01<br><br>OV-104:<br>209:01:28:10<br><br>DISTANCE:<br>4,525,299 sm |  |  |                               |  |     |  | Continued...<br><br>RENDEZVOUS #58:<br>- Rendezvous and Dock with ISS to PMA 2 Lab Fwd Port.<br><br>FIRSTS:<br>- First flight with all three Block II SSME's.<br>- First flight of FSW OI-29.<br>- First operation availability of delayed TAL.<br><br>EVENTS:<br>- MC-4 Maneuver at 100:15:04:09, 1:18:19:50, Delta V 2 fps, resultant altitude 204.0 by 211.3 nm.<br>- ISS Capture at 01/19:20:09 MET, 100:16:04:28Z.<br>- ISS Hard Dock at 1/19:34:46 MET, 100:16:19:05Z.<br><br>EVENTS (Continued):<br>- EVA 1 Start at 2:17:52 MET, 101:14:36Z, duration 7H48M. Installed Port & Stbd Fwd Struts to S0 truss and Port & Stbd avionics trays, deployed aft Umbilical tray, and installed TUS-1 cable.<br>- EVA 2 Start at 4:17:25 MET, 103:14:09Z, duration 7H30M. Installed Aft Port & Stbd Struts, installed TUS-2 cables, installed A/L handrail, Mated MT/MBS feed through cable.<br>- Reboost 1 at 5:01:59 MET, 103:22:44Z, Delta V 3.2 fps, alt. increase 0.95 nm, orbit 212 x 205 nm.<br>- EVA 3 Start at 5:17:04 MET, 104:13:48Z, duration 6H27M. Installed J300/400 panels, released capture claw, installed CID's 7 & 8, removed MT Launch restraints. Removed MT RPCM Thermal cover.<br>- Reboost 2 at 6:01:00 MET, 104:21:44Z, Delta V 3.4 fps, alt. increase 1.0 nm, orbit 212 x 206 nm.<br>- EVA 4 Start at 7:17:45:17 MET, 106:14:29:36Z, duration 6H37M. Installed Node & U.S. Lab EVA lights, released LCA guides, S0 handrails, MT energy absorbers, and deployed A/L spur & EV-CPDS.<br>- Reboost 3 at 8:14:35:01 MET, 107:11:19:20Z, Delta V 12.8 fps, alt. increase orbit to 213.8 by 206.3 nm.<br>- Cargo transferred to ISS = 28944 lbs (S0 ITS 26716, middeck 2228): ISS to Atlantis middeck 2607 lbs.<br>- Transfers to ISS: O <sub>2</sub> 146 lb, N <sub>2</sub> 45 lb, and water 1465 lb (1397 lb in 14 CWC's +68 lbs in three PWR's)<br>- Total transfers to ISS = 30600 lbs, net transfer 27993 lbs (30600 minus 2607)<br>- Hatch close between ISS and Atlantis at 107:16:04Z, 11:04 AM CDT, Wednesday, 4/17/02<br>- Undocked at 107:18:31Z, 8:21:47 MET, 1:31 AM CDT, 4/17/02<br>- ISS Visitor Time is 7:02:12:30.<br>- Jerry Ross total EVA time is U.S. record of 58H18m.<br><br>FLIGHT DURATION CHANGES: NONE<br>- Planned Landing at KSC on orbit 171. MLGTD on orbit 171 at KSC runway 33 at 109:16:26:58Z, 4:26:58 PM EDT, 10:19:42:39 MET. |
|  |         |   |   |  |  | ABOVE: STS110-E-5732 --- STS-110 & Exp 4 crews in ISS Destiny Lab. From the left (front row): Ellen Ochoa/MS, CDR Bloomfield, & Exp 4 CDR Yuri I. Onufrienko. From the left (middle row): Daniel W. Bursch Exp 4/FE, Walheim/MS, & Carl E. Walz, Exp 4/FE. From the left (back row): PLT Frick, Ross/MS, Morin/MS, & Smith/MS. |                               |  |     |  |   |
|  |         |   |   |  |  | LEFT: STS110-E-5926 (17 April 2002) --- New ISS configuration as viewed from departing Atlantis.   |                               |  |     |  |   |

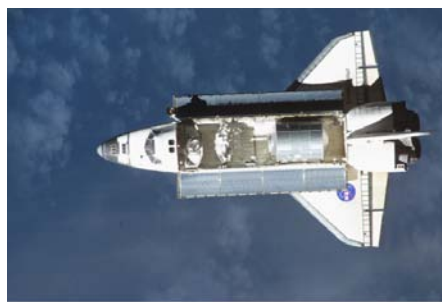
# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                             | ORBITER               | CREW<br>7 UP/7 DOWN<br><br>TITLE, NAMES<br>& EVA'S   | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br><br>AND<br>ET  | ORBIT         |                     | FSW          | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |  |
|-------------------------------------|-----------------------|--|---|--|--|---|---------------|---------------------|--------------|--|--|--|
| STS-111/<br>ISS UF-2                | OV-105<br>(Flight 18) | CDR:<br>Kenneth D. Cockrell<br>(Flt 5 - STS-56, STS-69,<br>STS-80, STS-98)<br>P664/R159/V121/M140                            | KSC 39A<br>156:21:22:49Z<br>5:22:49 PM EDT (P)<br>5:22:49 PM EDT (A)<br>Wednesday 13<br>6/5/02 (10)   | EDW 22, CONC<br>EDW 49, CONC 30<br>170:17:57:42Z<br>10:57:42 AM PDT<br>Wednesday 14<br>6/19/02 (6)   | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>98/72/104.5<br><br>1 = 2050 (3)<br>2 = 2044 (7)<br>3 = 2054 (4)<br><br>ALL BLOCK II<br>SSME's<br><br>M 3 EOM:<br>WEIGHT:<br>220334 LBS<br>X CG:<br>1083.62<br><br>LANDING:<br>WEIGHT:<br>220279 LBS<br>X CG:<br>1085.30 | BI-113<br><br>RSRM<br>84<br><br>ET-113<br><br>SLWT-19<br><br>ET<br>IMPACT<br>1:13:47<br>MET<br><br>LAT:<br>37.3°S<br><br>LONG:<br>160.1°W | 51.60<br>(14) | DIRECT<br>INSERTION | OI-29<br>(2) | CARGO:<br>36082 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>29712 LBS<br><br>DEPLOYED:<br>9512 LBS<br><br>NON-DEPLOYED:<br>906 LBS<br><br>MIDDECK:<br>288 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1130507 LBS<br>NON-DEPLOYED:<br>1534522 LBS<br>CARGO TOTAL:<br>3435911 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3065<br>FUEL BIAS: 937<br>FINAL TDDP: 2484<br>RECON: 1870<br><br>PAYLOADS:<br>PLB:<br>ISS UF-2<br>(MPLM, MBS,<br>PDGF, SMOP,<br>SSRMS, WRJ,<br>RMS, ODS)<br><br>MIDDECK:<br>ISS UF-2<br>RAMBO<br><br>5 CRYO TK SETS<br>6 GN2 TANKS<br><br>RMS 67<br><br>RMS USED FOR<br>ISS MPLM<br>DEPLOY AND<br>RETRIEVE AND<br>EVA SUPPORT | <b>Brief Mission Summary:</b> The STS-111/UF 2 (14 <sup>th</sup> ISS mission) provided a new crew to the ISS, transfer of supplies and equipment via the Leonardo MPLM, and three EVA's for ISS assembly. The Shuttle RMS was used to successfully install the Mobile Remote Service Base System to the Mobile Transporter on the Destiny Lab. This allows the Canadarm2 to travel the length of the ISS for future construction tasks.<br><br>KSC W/D: OPF 92, VAB 7, PAD 33 = 132 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Launch was scheduled for 5/2/02.<br>- Postponed launch to 5/31/02 to the end of a Beta Cutout and allow time to train EVA crew to R&R SSRMS failed Wrist Roll Joint.<br>- Advanced launch to 5/30/02 after analysis indicated adequate power generation using an ISS Pitch attitude bias.<br><br>LAUNCH SCRUBS:<br>- Scrubbed Thursday 5/30/02 Launch at L-24M53S due to opaque anvils within 30 nm circle while holding at T-9 minutes. PLT was 7:44:26 PM EDT with a window of 4M9S. Lightning was present throughout a wide area in Florida with occasional strike within 30 nm circle and thunderstorms were forecast. Weather forecast 70 percent chance NO GO for launch due to continuing anvil clouds, lightning, and thunderstorms through Monday, June 3. An upper Low is bringing in moist air from the tropics. Decision was made to hold a tanking MMT on Friday, May 31, where it was decided not to tank. Forecast included thunderstorms, anvil clouds, and chance of hail.. During the count, the L OME GN2 Regulator leaked and increased the accumulator pressure. Regulator locked up after a test. Went into a 24-hour Scrub turnaround. RTLS and Range Weather Scrub.<br>- A Tanking MMT was held on Friday, 5/31/02 and a decision was made not to tank due to inclement observed and forecast weather. There was a tanking weather violation with observed lightning within 5 nm. Launch forecast was for attached anvil clouds, thunderstorms, lightning, and precipitation. Tanking, RTLS, and Range Weather Scrub.<br>- A tentative decision was made to try for a Monday, 6/3 launch but keep an eye on the weather and hold a special MMT at 6:30 PM CDT (Later changed to 1:00 PM CDT) to decide whether to hold a tanking MMT on Saturday, 6/1.<br>- At the 1:00 PM CDT MMT, it was decided to top-off the cryos and reload the GN <sub>2</sub> (and at the same time to run another GN <sub>2</sub> regulator test) with a target of a Monday evening launch. This would allow three launch opportunities based on Range schedule on Monday, Tuesday, and Wednesday. Tentative plans were made for a tanking MMT on Monday. On Friday, the GN <sub>2</sub> was reloaded and the regulator failed the leak test. At a Saturday morning management meeting, it was decided to replace the L OME GN <sub>2</sub> Regulator, and with success oriented schedule, it would lead to a launch date of NET Tuesday 6/4/02. On Sunday morning, management decided to re-target the launch date to Wednesday, 6/5 due to delays in completing GSE work. Wednesday launch was confirmed later. Technical Scrub.<br><br>Continued... |  |
| SEQ<br>FLT #110                     | Endeavour             | OMS PODS:<br>LPO4-25<br>RPO1-32<br>FRC5-18   | LAUNCH WINDOW:<br>4M39S PLT (In-Plane<br>Time) ISS<br>Planar/Phase  | DEORBIT BURN:<br>170:16:50:26Z<br><br>X RANGE: 603 NM<br><br>ORBIT DIR: AL 31<br><br>AIM PT: NOMINAL   |  |   |               |                     |              |  |  |  |
| KSC-110                             |                       | PLT:<br>Paul S. Lockhart<br>P665/R279/M245   | LAUNCH WINDOW:<br>4M39S PLT (In-Plane<br>Time) ISS<br>Planar/Phase  | DEORBIT BURN:<br>170:16:50:26Z<br><br>X RANGE: 603 NM<br><br>ORBIT DIR: AL 31<br><br>AIM PT: NOMINAL   |  |   |               |                     |              |  |  |  |
| PAD<br>39A-62                       |                       | M/S 1/EV2:<br>Philippe Perrin<br>(France - CNES)<br>P666/R280/M246   | EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN  | MLGTD: 3058 FT<br>170:17:57:42Z<br>VEL: 197 KGS<br>193 KEAS<br>HDOT: -2.2 FPS<br><br>TD NORM 195:<br>3070 FT<br><br>NLGTD: 6353 FT<br>170:17:57:53Z<br>VEL: 146 KGS<br>137 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE<br>DEPLOY: 186 KEAS<br>170:17:57:45Z<br><br>BRK INIT: 75 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>170:17:58:23Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.4 PK 5.5<br><br>WHEELS STOP:<br>170:17:58:46Z<br>12677 FT<br><br>ROLLOUT:<br>9619 FT<br>64 SEC<br><br>WINDS: 3T, 4R<br>OFFICIAL:<br>35005p08<br>SS: H3, R4<br>PK: H5, R6<br><br>DENS ALT:<br>1260 FT |  |   |               |                     |              |  |  |  |
| MLP-1                               |                       | M/S 2/EV1:<br>Franklin R. Chang-Diaz<br>(Flt 7 - STS 61-C, STS-34,<br>STS-46, STS-60, STS-75,<br>STS-91)<br>P667/R89/V46/M81 | SELECTED:<br>RTLS: KSC 33/N/SFD<br>TAL: MRN 20/N/N<br>AOA: KSC 15/C/I/N<br>PLS: EDW 22/N/N  | MLGTD: 3058 FT<br>170:17:57:42Z<br>VEL: 197 KGS<br>193 KEAS<br>HDOT: -2.2 FPS<br><br>TD NORM 195:<br>3070 FT<br><br>NLGTD: 6353 FT<br>170:17:57:53Z<br>VEL: 146 KGS<br>137 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE<br>DEPLOY: 186 KEAS<br>170:17:57:45Z<br><br>BRK INIT: 75 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>170:17:58:23Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.4 PK 5.5<br><br>WHEELS STOP:<br>170:17:58:46Z<br>12677 FT<br><br>ROLLOUT:<br>9619 FT<br>64 SEC<br><br>WINDS: 3T, 4R<br>OFFICIAL:<br>35005p08<br>SS: H3, R4<br>PK: H5, R6<br><br>DENS ALT:<br>1260 FT |  |   |               |                     |              |  |  |  |
| 14TH<br>SHUTTLE<br>FLIGHT<br>TO ISS |                       | M/S 3 UP/EXP 5 Flt Eng:<br>Peggy A. Whitson<br>P668/R281/F35   | TDEL:<br>0.12 -0.058/-0.20  | MLGTD: 3058 FT<br>170:17:57:42Z<br>VEL: 197 KGS<br>193 KEAS<br>HDOT: -2.2 FPS<br><br>TD NORM 195:<br>3070 FT<br><br>NLGTD: 6353 FT<br>170:17:57:53Z<br>VEL: 146 KGS<br>137 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE<br>DEPLOY: 186 KEAS<br>170:17:57:45Z<br><br>BRK INIT: 75 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>170:17:58:23Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.4 PK 5.5<br><br>WHEELS STOP:<br>170:17:58:46Z<br>12677 FT<br><br>ROLLOUT:<br>9619 FT<br>64 SEC<br><br>WINDS: 3T, 4R<br>OFFICIAL:<br>35005p08<br>SS: H3, R4<br>PK: H5, R6<br><br>DENS ALT:<br>1260 FT |  |   |               |                     |              |  |  |  |
|                                     |                       | M/S 4 UP/EXP 5 CDR:<br>Valery C. Korzun<br>(Russia)<br>P669/R282/M247  | MAX Q NAV:<br>748 722   | MLGTD: 3058 FT<br>170:17:57:42Z<br>VEL: 197 KGS<br>193 KEAS<br>HDOT: -2.2 FPS<br><br>TD NORM 195:<br>3070 FT<br><br>NLGTD: 6353 FT<br>170:17:57:53Z<br>VEL: 146 KGS<br>137 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE<br>DEPLOY: 186 KEAS<br>170:17:57:45Z<br><br>BRK INIT: 75 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>170:17:58:23Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.4 PK 5.5<br><br>WHEELS STOP:<br>170:17:58:46Z<br>12677 FT<br><br>ROLLOUT:<br>9619 FT<br>64 SEC<br><br>WINDS: 3T, 4R<br>OFFICIAL:<br>35005p08<br>SS: H3, R4<br>PK: H5, R6<br><br>DENS ALT:<br>1260 FT |  |   |               |                     |              |  |  |  |
|                                     |                       | M/S 5 UP/EXP 5 Flt Eng:<br>Sergei Y. Treschev<br>(Russia)<br>P670/R283/M248  | SRB STG:<br>2:04 2:05   | MLGTD: 3058 FT<br>170:17:57:42Z<br>VEL: 197 KGS<br>193 KEAS<br>HDOT: -2.2 FPS<br><br>TD NORM 195:<br>3070 FT<br><br>NLGTD: 6353 FT<br>170:17:57:53Z<br>VEL: 146 KGS<br>137 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE<br>DEPLOY: 186 KEAS<br>170:17:57:45Z<br><br>BRK INIT: 75 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>170:17:58:23Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.4 PK 5.5<br><br>WHEELS STOP:<br>170:17:58:46Z<br>12677 FT<br><br>ROLLOUT:<br>9619 FT<br>64 SEC<br><br>WINDS: 3T, 4R<br>OFFICIAL:<br>35005p08<br>SS: H3, R4<br>PK: H5, R6<br><br>DENS ALT:<br>1260 FT |  |   |               |                     |              |  |  |  |
|                                     |                       | M/S 3 DN/EXP 4 Flt Eng<br>Carl Walz<br>(Flt 4 - STS-51, STS-65,<br>STS-79, STS-108 Up)<br>P671/R170/V106/M148                | PERF: NOMINAL<br><br>2 ENG TAL (MRN):<br>2:24 2:29  | MLGTD: 3058 FT<br>170:17:57:42Z<br>VEL: 197 KGS<br>193 KEAS<br>HDOT: -2.2 FPS<br><br>TD NORM 195:<br>3070 FT<br><br>NLGTD: 6353 FT<br>170:17:57:53Z<br>VEL: 146 KGS<br>137 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE<br>DEPLOY: 186 KEAS<br>170:17:57:45Z<br><br>BRK INIT: 75 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>170:17:58:23Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.4 PK 5.5<br><br>WHEELS STOP:<br>170:17:58:46Z<br>12677 FT<br><br>ROLLOUT:<br>9619 FT<br>64 SEC<br><br>WINDS: 3T, 4R<br>OFFICIAL:<br>35005p08<br>SS: H3, R4<br>PK: H5, R6<br><br>DENS ALT:<br>1260 FT |  |   |               |                     |              |  |  |  |
|                                     |                       | M/S 4 DN/EXP 4 Flt Eng:<br>Daniel Bursch<br>(Flt 4 - STS-51,<br>STS-68, STS-77,<br>STS-108 Up)<br>P672/R169/V109/M147        | NEG RETURN:<br>3:52 3:57<br><br>PTA (U/S 182):<br>4:49 4:45<br><br>DROOP (ZZA 109):<br>5:23 5:24<br><br>PTM (U/S 182):<br>6:11 6:06<br><br>SE TAL (ZZA 104):<br>6:03 6:06<br><br>VI:<br>25821 25815 | MLGTD: 3058 FT<br>170:17:57:42Z<br>VEL: 197 KGS<br>193 KEAS<br>HDOT: -2.2 FPS<br><br>TD NORM 195:<br>3070 FT<br><br>NLGTD: 6353 FT<br>170:17:57:53Z<br>VEL: 146 KGS<br>137 KEAS<br>HDOT: -5.9 FPS<br><br>DRAG CHUTE<br>DEPLOY: 186 KEAS<br>170:17:57:45Z<br><br>BRK INIT: 75 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>170:17:58:23Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.4 PK 5.5<br><br>WHEELS STOP:<br>170:17:58:46Z<br>12677 FT<br><br>ROLLOUT:<br>9619 FT<br>64 SEC<br><br>WINDS: 3T, 4R<br>OFFICIAL:<br>35005p08<br>SS: H3, R4<br>PK: H5, R6<br><br>DENS ALT:<br>1260 FT |  |   |               |                     |              |  |  |  |
|                                     |                       | Continued...   | Continued...  | Continued...   |  |   |               |                     |              |  |  |  |









ISS004-E-13246 (7 June 2002) --- Endeavour approaches ISS with Leonardo (MPLM) supplies.



ISS004-E-13246 (7 June 2002) --- Endeavour approaches ISS with Leonardo (MPLM) supplies.






# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW 7 UP/7 DOWN<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|---|---|--|---|-----------------|-------|--|-----|---|---|
| STS-111/ ISS UF-2   |         | Continued...<br><br>M/S 5 DN/EXP 4 CDR: Yury I. Onufrienko (Russia) (Flt 1 - STS-108 Up) P673/R273/R239<br><br>SS EVA 80 DOCKED QUEST EVA 6 EMU/TETHERED EVA 73 SCHEDULED EVA 74 DURATION 7:14<br><br>SS EVA 81 DOCKED QUEST EVA 7 EMU/TETHERED EVA 74 SCHEDULED EVA 75 DURATION 5:00<br><br>SS EVA 82 DOCKED QUEST EVA 8 EMU/TETHERED EVA 75 SCHEDULED EVA 76 DURATION 7:17<br><br>MCC WHITE FCR (40)<br><br>FLIGHT DIRECTORS: ISS Ld/O1-R. E. LaBrodre<br>ISS O 2 - J. M. Curry<br>ISS PLNG - B. C. Lunney<br>STS LD/O 1 - P. S. Hill<br>STS O 2 - A. J. Ceccacci<br>STS O 3/PLNG - K. B. Beck<br>A/E - J. P. Shannon<br>MOD - R. E. Castle | Continued...<br><br>OMS-2: 38:42 98 FPS 38:45 95 FPS  | Continued...<br><br>FLT DURATION: 13:20:34:53<br><br>S/T: 990:22:48:54<br><br>OV-105: 192:19:24:40<br><br>DISTANCE: 5,781,115 sm | <br><br>ISS004-E-13426 --- Exp 4 (dark blue shirts), STS-111 (green shirts), and Exp 5 (medium blue shirts) crews in ISS Destiny Lab. Exp 4 crew, from front to back, CDR Onufrienko (RSA), Bursch/FE, & Walz/FE. STS-111 crew, from front to back, CDR Cockrell, Chang-Diaz/MS, PLT Lockhart, & Perrin/MS (CNES). Exp 5 crew, from front to back, CDR Korzun (RSA), Whitson/FE, & Treschev/FE (RSA). |                 |       |  |     | Continued...<br><br><b>LAUNCH WINDOW:</b><br>- The June 4, 2002 launch window opened at 156:21:18:19Z and closed at 156:21:27:28Z giving a total window of 9M09S. Using a Preferred Launch Time of 156:21:22:49Z (5:22:49 PM EDT), the window was 4M39S.<br><br><b>LAUNCH DELAYS:</b> NONE<br>- Launch occurred On-Time at 156:21:22:49Z (5:22:49 PM EDT) on Wednesday, June 5, 2002.<br><br><b>TAL WX:</b><br>- Zaragoza (Prime) was forecast and observed NO GO for precipitation. Ben Guerir was forecast and observed NO GO for Head Winds of 27 Knots. Moron (Selected) was forecast and observed GO.<br><br><b>PERFORMANCE ENHANCEMENTS:</b><br>- Standard Set plus: (1) PE Operational High Q TRN/MAY, (2). OMS Assist, (3) 52 NM MECO, (4) Del Psi<br><br><b>FLIGHT DURATION CHANGES:</b><br>- Total Extensions: 2 Days Plus 2 Revs. Planned landing at KSC on Orbit 186 at 12:59 PM EDT on June 17, 2002. Did not call up EDW. Closed PLBD's but did not fluid load crew. Waved off Orbit 186 due to forecast ceiling, precipitation, crosswinds, and thunderstorms and observed precipitation, thunderstorms within 20 nm, ceiling 2600 broken and visibility violations. Waved off landing at KSC on Orbit 187 with similar forecast and observed at landing time. Extended one day. Brought up EDW for EOM+1. Waved off landing at KSC on Orbit 201 due to forecast ceiling, precipitation, and thunderstorms. Observed ceiling, precipitation, thunderstorms, and visibility violations. Waved off Orbit 202 due to similar forecasts and observations. Extended the second day.<br>- EOM+2 was "pick the landing site" day. EOM-2 PLBD's were closed for Planned landing at KSC on Orbit 216 at 170:14:52Z. Crew not in suits and no fluid load. Waved off landing at KSC on Orbit 216 at approximately Tig -40 minutes due to forecast and observed thunderstorms, attached anvil clouds, and low ceiling within 30 nm. Waved off landing at KSC on Orbit 217 at approximately Tig -20 minutes due to thunderstorms, attached anvils, and low clouds. (Two orbits wave-off).<br>- Decision made to land at EDW 22 on Orbit 218. MLGTD at 170:17:57:42Z, 10:57:42 AM PDT (MET 13:20:34:57) on Wednesday, June 19, 2002.<br>- NLGTD at 170:17:57:53Z.<br>- Total Flight Duration Extensions: Two Days plus two orbits. |   |
| <br><br> |         |   | <br><br>STS111-E-5095 (7 June 2002) --- EXP 4 CDR Onufrienko (Russia) greets EXP 5 CDR Korzun (Russia, back to camera) with STS-111 CDR Cockrell partially visible at right. |  |   |                 |       | <b>FIRSTS:</b><br>- First use of orbiter oxygen for EVA pre-breathe for astronauts in ISS Joint Airlock.<br><br>Continued... |     |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-150 - STS-111/UF-2

| FLT NO.                                  | ORBITER | CREW 7 UP/7 DOWN<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME,<br>LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|---------|---|--|---|---|--------------------|--------------------|-----|---|---|
| STS-111/<br>ISS UF-2<br><br>Continued... |         | <br>5111E5238  |  |   |   |                    |                    |     |   | Continued...<br><br><b>EVENTS:</b><br>- MC4 Maneuver Start at 158:15:16:16Z, 1:127:53:27 MET, 1.2 ft/sec, altitude 203.3 by 211.9 nm.<br>- ISS Capture at 158:16:24Z, 1:19:01 MET.<br>- ISS Hard-Docked at 158:17:26:32Z, 1:20:03:43 MET<br>- Official Transfer Time (IELK time) from Expedition 4 Crew to Expedition 5 Crew = 158:22:55Z, 5:55 PM CDT, June 7, 2001.<br>- Expedition 4 ISS Habitant Time is 181:00:43.<br>- MPLM installed on Node 1 by RMS at 159:14:28Z, 2:17:05 MET<br>- EVA 1 Start at 160:15:26Z, 3:18:03 MET and End 160:22:40Z, 04:01:17 MET, duration 7:14. Installed PDGF on P6 Truss, mated heater cables from MBS to MT, and installed SM debris protectors on PMA1 for future installation on SM.<br>- Photographed failed ISS CMG-1.<br>- Reboost Maneuver 1 Start at 161:20:53:24Z, 4:23:30:35 MET, Delta V 3.0 fps, 0.8 nm altitude increase, altitude 212 by 205 nm.<br>- EVA 2 Start at 162:15:19Z, 5:17:58 MET and End 162:20:19Z, 5:22:58 MET, duration 5:00, final installation of MBS to MT (Connected video and data cables), attached bag with contingency extension cable to MBS.<br>- Reboost Maneuver 2 Start at 163:12:08:02Z, 6:15:45:13 MET, Delta V 3.0 fps, altitude increase .81 nm, Orbit 212.8 by 206.2 nm<br>- EVA 3 Start at 164:15:16Z, 7:17:53 MET, duration 7:17. R&R SSRMS Wrist Roll Joint (WRJ).<br>- Reboost Maneuver 3 Start at 165:11:51:26Z, 6:14:28:37 MET, Delta V 12.5 fps, altitude increase 3.6 nm, orbit 214.4 by 211.1 nm.<br>- Transfers from shuttle to ISS = 9512 lbs (from MPLM = 8062 lbs and from middeck = 1450 lbs). Transfers from ISS to Shuttle = 6342 lbs (to MPLM = 4668 lbs and to middeck = 1675 lbs). Consumables transfer: Total water = 884.9 lbm (8 CWC's with 798.9 and 4 PWR's with 86.0 lbm). Total shuttle O2 transferred = 34 lbm for the 3 EVA prebreathes in JAL, N2 tank transfer of 18.9 lbm.<br>- Undocked at 166:14:31Z, 9:17:08 MET<br>- STS-111/ISS Visitor Time is 7:31:04:28 (Docking to Undocking)<br>- Expedition 4 ISS Habitant Time is 181:00:43:00 (IELK S/L Xfer to IELK S/L Xfer), Expedition 4 broke U.S. Flight Time record, flight time is 195:19:38:14 (STS-108 L/O to STS-111 MLGTD).<br>- Carl Walz record total flight time is 230:13:02:44. Dan Bursch Total Flight Time is 226:22:14:48.<br>- Sep Burn 166:16:14:27Z, 6:18:51:38 MET.<br>- Orbit Adjust Maneuver at 166:17:57:48Z, 9:20:34:59 MET, Delta V 45.6 fps, orbit was 186.1 by 211.9 nm.<br><br><b>RENDEZVOUS # 59:</b> Rendezvous and Dock with ISS (Dock to PMA2 Lab Fwd Port) |
|  |         | STS111-E-5238 (11 June 2002) --- Perrin/MS1 (France) installs the Mobile Remote Servicer Base System (MBS) on the ISS railcar.  |  |   |   |                    |                    |     |   | <br><b>JSC2002-E-23100 --- Flight Directors Steve Stich (right foreground) and John Shannon; along with astronauts William A. Oefelein and Kenneth T. Ham, spacecraft communicators (CAPCOM), watch the large MOCR screens.</b>   |
|  |         | <br><b>JSC2002-E-23106 --- J. Milton (Milt) Heflin (standing), Chief, Flight Director's Office, along with Dan Carpenter (background), Director, Public Affairs Office, and Rob Navias, lead STS-111 PAO commentator, discuss mission in JSC MCC WFCR</b> |  |   |   |                    |                    |     |   | <b>SIGNIFICANT ANOMALIES:</b><br>- Right Main Engine High Pressure Fuel Pump Speed Sensor Failure<br>- Flash Evaporator Controller Primary B failure<br>- WIF Adapter Hitch Pin Anomaly<br>- EV2 Boot Fit Problems during EVA 1<br>- EVA Communications Anomaly on STS-111 EVA 3<br>- AVIU-Camcorder Failed<br>- BPSMU XMIT/COM Dey causes Video to Flicker<br>- LL QUAD Reflected Power Spikes<br>- Loss of BIOMED Data on EVA 1   |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-151 - STS-112/9A

| FLT NO.  | ORBITER   | CREW (6)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET   | ORBIT INC HA/HP  | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|---|---|---|---|---|--|---|--|---|
| STS-112/ISS 9A<br><br>SEQ FLT #111<br><br>KSC-111<br><br>PAD 39B-49<br><br>MLP-3<br><br>15TH SHUTTLE FLIGHT TO ISS | OV-104 (Flight 26)<br><br>Atlantis<br><br>OMS PODS: LPO3-30 RPO4-26 FRC4-26 | CDR: Jeffrey S. Ashby (Flt 3 - STS-93, STS-100) P674/R251/V169/M218<br><br>PLT: Pamela A. Melroy (Flt 2 - STS-92) P675/R261/V175/F34<br><br>M/S 1/EV1: David A. Wolf (Flt 3 - STS-58, Up to Mir on STS-86, Dn on STS-89) P676/R173/V147/M151<br><br>M/S 2: Sandra H. Magnus P677/R284/F36<br><br>M/S 3/EV2: Piers J. Sellers P678/R285/M249<br><br>M/S 4: Fyodor N. Yurchikhin (Russia) P679/R286/M250<br><br>SS EVA 83 DOCKED QUEST EVA 9 EMU/TETHERED EVA 76 SCHEDULED EVA 77 DURATION 7:01<br><br>SS EVA 84 DOCKED QUEST EVA 10 EMU/TETHERED EVA 77 SCHEDULED EVA 78 DURATION 6:04<br><br>SS EVA 85 DOCKED QUEST EVA 11 EMU/TETHERED EVA 78 SCHEDULED EVA 79 DURATION 6:36 | KSC 39B 280:19:45:51Z 3:45:51 PM EDT (P) 3:45:51 PM EDT (A) Monday (13) 10/7/02 (11)<br><br>LAUNCH WINDOW: 4M59S USING PLT (ISS IN-PLANE TIME)<br><br>EOM PLS: KSC TAL: ZZA TAL WX: MRN<br><br>SELECTED: RTLS: KSC 33/N/N TAL: ZZA 30/N/SFD AOA: KSC 33/N/N PLS: EDW 04/N/N<br><br>TDEL: -0.11 -0.368/-0.490<br><br>MAX Q NAV: 726 725<br><br>SRB STG: 2:04 2:02<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN): 2:33 2:30<br><br>NEG RETURN: 3:54 3:54<br><br>PTA (U/S 182): 4:57 4:55<br><br>PTM (U/S 182): 6:14 6:10<br><br>SE TAL (ZZA): 6:04 6:08<br><br>MECO CMD: 8:21.5 8:24.5<br><br>VI: 25822 25815<br><br>OMS-2: 38:40 38:42 96.1 FPS 95.9 FPS | KSC 33 (KSC 60) 291:15:43:41Z 11:43:41 AM EDT<br><br>Friday 13 10/18/02 (9)<br><br>DEORBIT BURN: 291:14:36:14Z<br><br>X RANGE: 21 NM<br><br>ORBIT DIR: AR 12<br>AIM PT: NOMINAL<br>MLGTD: 3072 FT 291:15:43:41Z VEL: 186 KGS 187 KEAS HDOT: -1.0 FPS<br>TD NORM 195: 2851 FT<br><br>NLGTD: 5475 FT 291:15:43:48Z VEL: 161 KGS 160 KEAS HDOT: -6.2 FPS<br><br>DRAG CHUTE DEPLOY: 157 KEAS 291:15:43:51Z<br><br>BRK INIT: 86 KGS<br><br>DRAG CHUTE JETTISON: 51 KGS 291:15:44:18Z<br><br>BRK DECEL FPS2: AVE 6.9 PK 9.1<br><br>WHEELS STOP: 291:15:44:33Z 11377 FT<br><br>ROLLOUT: 8305 FT 52 SEC<br><br>WINDS: 11H, 5R KTS OFFICIAL: 01011P17 AVE: 8H 11R PK: 13H 11R<br><br>DENS ALT: 1019 FT | 104/104/ 109%<br><br>PREDICTED: 100/104.5/104.5/ 72/104.5<br><br>ACTUAL: 100/104.5/97/ 72/104.5<br><br>1 = 2048 (5)<br>2 = 2051 (4)<br>3 = 2047 (8)<br><br>M 3 EOM:<br><br>WEIGHT: 202688 LBS<br><br>X CG: 1087.08<br><br>LANDING:<br><br>WEIGHT: 202621 LBS<br><br>X CG: 1088.94 | BI-115<br><br>RSRM 87<br><br>ET-115<br><br>SLWT-20<br><br><br><br>ET IMPACT<br><br>1:14:01 MET<br><br>LAT: 36.97°S<br><br>LONG: 159.3°W | 51.60 (15)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 126.4 x 85.0 NM<br><br>DEORBIT: HA 220.0 NM HP 146.0 NM<br><br>VELOCITY: 25917 FPS<br><br>ENTRY RANGE: 4342 NM | OI-29 (3)<br><br>CARGO: 37441 LBS<br><br>PAYLOAD CHARGEABLE: 29502 LBS<br><br>DEPLOYED: 29543 LBS<br><br>NON-DEPLOYED: 0 LBS<br><br>MIDDECK: 382 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1160050 LBS NON-DEPLOYED: 1534904 LBS CARGO TOTAL: 3473352 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 3065 FUEL BIAS: 937 FINAL TDDP: 2744 RECON: 3860<br><br>PAYLOADS: PLB: ISS 9A (ITS S1 TRUSS) CETA CART A RMS, ODS<br><br>MIDDECK:<br><br>ISS 9A (SHIMMER, RAMBO)<br><br>5 CRYO TK SETS 6 GN2 TANKS RMS 69<br><br>RMS USED FOR TV SUPPORT DURING S1 INSTALL (SSRMS INSTALL) | <b>Brief Mission Summary:</b> The STS-112/9A (15 <sup>th</sup> ISS mission) delivered the 45-foot long, 15 ton S1 Truss for further assembly of ISS. The S1 Truss was attached to the starboard side of the Center S0 Truss allowing for the outboard expansion of the rail system to prepare for future ISS growth. This truss also contains a new cooling system, S-band Comm, and the first Thermal Radiator Rotary Joint (TRRJ).<br><br>KSC W/D: OPF 106, VAB 6, PAD 25 = 139 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Launch was postponed from June after Post-STS-110 visual inspections of OV-104 Inconel 12" MPS LH <sub>2</sub> Flowliners revealed three cracks to SSME 2. Subsequent inspections found cracks in other Orbiter LH <sub>2</sub> Flowliners:<br>- OV-103 - three cracks (SSME 1)<br>- OV-105 - one crack (SSME 1) and one crack (SSME 2)<br>- MPTA - one crack (SSME 1)<br>- OV-102 three cracks (SSME 2). OV-102 flowliners are CRES. After analyses, tests, etc., including consideration of other repair techniques, the decision was made to use weld-repair technique and polishing of Flowliner holes.<br>- Severe cracks were found in Mobile Launch Platform Crawler-Transporter (CT-2) jacking cylinder bearings. CT-2 was repaired using undamaged spare and new bearings. CT-2 bearings will be replaced incrementally.<br>- These postponements resulted in rescheduling STS-112 and STS-113 ahead of STS-107. STS-112 launch date was set to October 2, 2002.<br><br>LAUNCH SCRUBS:<br>- Scrubbed October 2 Launch at approximately L-27 hours at an MMT due to the threat to JSC/MCC posed by Hurricane Lili in the Gulf of Mexico. Launch delayed for at least 24 hours. At approximately L-21 hours, the Space Shuttle and ISS Programs decided there was less risk to the MCC by implementing an orderly powerdown of the MCC with a launch in the Sunday/Monday timeframe. Weather Scrub.<br>- Early Wednesday morning, October 2, MCC-H transitioned USOS operations support to BCC HSG Moscow.<br>- At the October 2, 6:45 AM CST MMT, the decision was made not to launch earlier than Monday, October 7. This presumes a GO to begin Restoration of the MCC late Wednesday or early Thursday.<br>- MCC powerup/restoration began early Thursday morning, October 3. ISS operations in MCC will be resumed Thursday night. Launch scheduled for Monday, October 7. |   |

STS-112

ASHBY MELROY WOLF

MAGNUS YURCHIKHIN SELLERS

9A

STS-112

ISS 9A

STS112\_ETCAM\_typical --- Typical view during ascent from first ET Shuttle Observation Camera . (Courtesy MSFC ET Project Office)

Continued...







STS112\_ETCAM\_typical --- Typical view during ascent from first ET Shuttle Observation Camera . (Courtesy MSFC ET Project Office)

Continued...



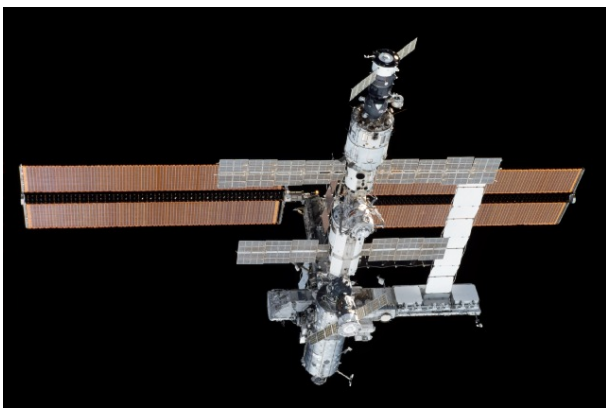


# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                        | ORBITER  | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT INC HA/HP | FSW | PAYLOAD WEIGHTS, PAYLOADS / EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--------------------------------|--|--|---|--|--|-----------------|-----------------|-----|--|--|
| STS-112/ISS 9A<br>Continued... |   | STS112-709-033 (12 October 2002) --- Newly installed Starboard S1 Truss and Canadarm2.   |   | Continued...<br>FLT DURATION:<br>10:19:57:50<br>S/T: 1001:18:46:44<br>OV-104:<br>219:21:26:00<br>DISTANCE:<br>4,513,015 sm |  |                 |                 |     |    | Continued...<br><b>LAUNCH WINDOW:</b><br>- Launch window opened at 280:19:40:51Z and closed at 280:19:50:50Z for a total launch window of 9m59s. In-plane time was 280:19:45:51Z for a launch window of 4m59s.<br><b>LAUNCH DELAYS:</b> NONE<br>- Launch occurred On-Time at 280:19:45:51Z, 3:45:51 PM EDT on Monday, October 7, 2002.<br><b>TAL WX:</b><br>- Zaragoza (prime and selected) and Moron (2-Eng TAL Call) were forecast and observed GO. Moron earlier forecast was NO GO for showers and anvils. Ben Guerir was not available.<br><b>PERFORMANCE ENHANCEMENTS:</b><br>- Standard Set plus: (1) PE Operational High Q TRN/OCT, (2) OMS Assist, (3) 52 NM MECO, (4) Del Psi<br><b>FLIGHT DURATION CHANGES:</b> NONE<br>- Planned landing at KSC on Orbit 171. MLGTD at KSC Runway 33 on Orbit 171 at 291:15:43:41Z, 11:43:41 AM EDT, 10:19:57:50 MET. NLGTD at 291:15:43:48Z, 11:43:48 AM EDT. STS-112 was the 75th planned landing at KSC, but the 60th actual landing at KSC, and the 36th landing on Runway 33.<br><b>FIRSTS/LASTS:</b><br>- First use of ET Shuttle Observation Camera during ascent.<br><b>EVENTS:</b><br>- MC4 Start at 282:14:18:46Z, 3.2 fps, orbit 200.4 by 213.6 nm.<br>- ISS Capture at MET 1:19:30:19, 282:15:16:10Z.<br>- Hard dock to PMA2 Lab Fwd Port complete at 1:19:44:06 MET, 282:15:29:57Z.<br>- PMA/APAS Hatch Open at 282:16:40Z, 1:20:55:09 MET. ODS Hatch open at 282:16:50Z, 1:21:05:09 MET.<br>- EVA 1 (JAL) Start at 283:15:21Z, 2:19:35 MET End at 283:22:22Z, 3:02:36 MET, duration 7h01m (Attached S1 to S0 Truss using SSRMS. Released CETA cart launch locks. Connected Zenith side power umbilicals and deployed S-Band Antenna. Installed S1 nadir ETVCG).<br>- First Reboost maneuver start at 285:10:52:48Z, 4:15:06:57 MET, delta V of 11.9 fps, altitude increase of 3.4 nm, orbit 216 by 204 nm.<br>- EVA 2 (JAL) Start at 285:14:30Z, 4:18:44 MET, End 285:20:34Z, 05:00:48 MET, duration 6h04m. (Installed Z1/P6, Z1/Lab and RBVM SPD's. Connected ATA Umbilicals. Installed Lab ETVCG. ZCG Activation).<br>Continued... |
|                                |  | STS112-326-033 --- Wolf (left) & Sellers during 2nd EVA. Wolf is anchored to a foot restraint on ISS's Canadarm2 while Sellers traverses along the airlock spur. |   |  |  |                 |                 |     |  |  |





# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.            | ORBITER | CREW (6)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br><br>AND<br>ET | ORBIT |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--------------------|---------|--------------------------------------|--|---|---|------------------------------|-------|--|-----|--|--|
| STS-112/<br>ISS 9A |         |                                      |  |   |   |                              |       |  |     |  | Continued...   |
| Continued...       |         |                                      |  |   |   |                              |       |  |     |  | <p><u>EVENTS (Continued):</u></p> <ul style="list-style-type: none"> <li>- Second Reboost maneuver (c3) start at 287:11:20:50Z, 6:15:34:59Z MET delta V = 6.9 fps, altitude increase 1.96 nm, orbit 219.4 by 203.3 nm.</li> <li>- EVA 3 (JAL) Start at 287:14:11:25Z, 6:18:25:34 MET, End 287:20:47Z, 07:01:01 MET, EVA duration 6h36m. (IUA on MT R&amp;R: S1 to S0 fluid (ammonia) jumper connections, removal of port and starboard keel pins, last of TRRJ SPD's, TRRJ bolts).</li> <li>- Total cargo transfers from Orbiter to ISS = 29120 lbm (S1 Segment = 27676 lbm), Total cargo transfers from ISS to Orbiter = 1351 lbm Consumables Transfer: H<sub>2</sub>O Total = 1658.1 lbm (16 CWC's with 1603.7 lbm and 3 PWR's with 54.4 lbm). Total N2 (Tank) = 68.2 lbm.</li> <li>- Total O<sub>2</sub> = 60 lbm (Pre-Breathe: EVA 1 = 10 lbm, EVA 2 = 10 lbm, EVA 3 = 10 lbm, Tank Transfer= 28 lbm).</li> <li>- Undocking at 289:13:13:25Z, 8:17:27:34 MET.</li> <li>- Total ISS Visitor Time = 6:21:33:28.</li> <li>- Post-undocking initial separation maneuver began at 289:13:13Z. ISS flyaround terminated at 289:14:30Z, 8:18:44 MET.</li> <li>- Final Separation at 289:15:00Z, 8:19:14 MET, delta V= 5.5 fps, resulting Orbit = 200.8 nm by 219.9 nm.</li> <li>- Orbit Adjust Maneuver at 290:20:26:51Z, 10:00:41:00 MET, delta V = 93.9 fps, Orbit 146.6 nm by 219.9 nm</li> <li>- Note: At 291:08:35Z, using Progress engines, raised the ISS 6.9 miles.</li> </ul> <p><u>RENDEZVOUS # 60:</u></p> <ul style="list-style-type: none"> <li>- Rendezvous and Dock with ISS (Dock to PMA2 Lab Fwd Port)</li> </ul> <p><u>SIGNIFICANT ANOMALIES:</u></p> <ul style="list-style-type: none"> <li>- Piece of debris impacted ETA ring near IEA box on LH SRB at 33 seconds.</li> <li>- Insulating foam was lost on ET-115 left bipod ramp (approx 4" X 5" X12") exposing bipod housing SLA closeout.</li> <li>- Primary Thruster L4D failed off due to low chamber pressure (IFA STS-112-V-01).</li> <li>- Panel F7 SM Alert Light Brightness</li> <li>- Supply Water Crossover Valve Circuit Breaker did not indicate Open</li> <li>- System A Pyros for SRB Holddown Posts and ET Vent Arm Systems did not fire at T-0 (IFA STS-112-K-01).</li> <li>- EVA Glove Wrist Tether Point Torn</li> <li>- RPOP PGSC (STS-5) Network Problem</li> <li>- Emergency Egress Net Daisy Wheel Knob broke</li> <li>- PCS 1 O2 Supply Pressure Indication failed OSH</li> <li>- MADS recorder "stuck" at beginning of tape (tape came off reel)</li> <li>- Forward RCS Primary Thruster F3F Failed On Heater</li> <li>- ICOM A from Shuttle to Station not operating</li> <li>- Handheld Microphone failed</li> </ul> |
|                    |         |                                      |  |   |   |                              |       |  |     |  |  <p>Left: JSC2002-E-41249--STS Lead FD Phil Engelauf in MCC WFCR reviewing Flight Day 2 activities.</p>   |
|                    |         |                                      |  |   |   |                              |       |  |     |  | <p>STS112-382-003 (16 October 2002) --- New ISS configuration as viewed from departing Atlantis.</p>  <p>JSC2002-01809 -- Members of MOD Planning Team in JSC MCC shuttle flight control room (WFCR). CAPCOM Stephanie D. Wilson holds the STS-112 mission logo. Flight Director John Curry stands to right of Wilson.</p>   |
|                    |         |                                      |  |   |   |                              |       |  |     |  |  <p>JSC2002-01806 -- STS-112/ISS-9A Orbit 1 Team in the ISS Flight Control Room (BFGR) in JSC MCC. Flight Director Mark Kirasich stands near center on front row. Left of center, ISS SPAN Team Lead Dan Bahadorani holds ISS logo.</p>   |

## Page 2-154 - STS-113/11A

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-155 - STS-113/11A

| FLT NO.                             | ORBITER | CREW 7 UP/7 DOWN<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/ EXP | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|-------------------------------------|---------|--|---|---|---|--------------------|--------------------|-----|-----------------------------------|--|
| STS-113/ISS 11A<br><br>Continued... |         | <p>Continued...</p> <p>SS EVA 86<br/>DOCKED QUEST EVA 12<br/>EMU/TETHERED EVA 79<br/>SCHEDULED EVA 80<br/>DURATION 6:45</p> <p>SS EVA 87<br/>DOCKED QUEST EVA 13<br/>EMU/TETHERED EVA 80<br/>SCHEDULED EVA 81<br/>DURATION 6:10</p> <p>SS EVA 88<br/>DOCKED QUEST EVA 14<br/>EMU/TETHERED EVA 81<br/>SCHEDULED EVA 82<br/>DURATION 7:00</p> <p>MCC WHITE FCR (42)</p> <p>FLIGHT DIRECTORS:<br/>ISS LD/O1 - A. F. Algate<br/>ISS O 2 - M. A. Kirasich<br/>ISS PLNG - A. P. Hasbrook<br/>STS LD/O 1 - P. L. Engelauf<br/>STS O 2 - C. A. Koerner<br/>STS O 3/PLNG - J. M. Curry<br/>A/E - J. P. Shannon<br/>MOD - R. E. Castle</p> | <p>Continued...</p> <p>OMS-2:<br/>38:12 37:49.2<br/>250 FPS 256 FPS<br/>2:42 5:31</p> | <p>Continued...</p> <p>S/T: 1015:13:34:10</p> <p>OV-105:<br/>206:14:12:06</p> <p>DISTANCE:<br/>5,735,600 sm</p> |   |                    |                    |     |                                   | <p>Continued...</p> <p><u>LAUNCH WINDOW:</u><br/>- ISS first Planar window opened at 328:00:44:48Z and closed at 328:0054:46Z with PLT at 328:00:49:47Z (7:49:47 PM EST) for a 7M08S launch window. Second Planar window opened at 328:00:47:56Z and closed at 328:00:57:55Z.</p> <p><u>LAUNCH DELAYS:</u> NONE<br/>- Launch occurred on time at 328:00:49:47Z, 7:49:47 PM EST Sat. 11/ 23/ 2002.</p> <p><u>TAL WX:</u><br/>- Zaragoza (prime and selected) was forecast and observed GO. Moron was forecast NO GO for ceiling (BKN 2500 ft and showers within 20 nm) but verified GO at landing time. 2-Eng TAL call ZZA. Ben Guerir was N/A, but was NO GO.</p> <p><u>PERFORMANCE ENHANCEMENTS:</u><br/>- Standard Set plus: (1) PE Operational High Q (WIN/DEC), (2) OMS Assist, (3) 52 NM MECO, (4) Del Psi</p> <p><u>FIRSTS/LASTS:</u><br/>- First flight with 3 Days Extension due to weather wave-offs.<br/>- Record Minimum Crossrange of 2.1 nautical miles.<br/>- John Herrington/MS2 is the first &amp; as of 2010 the only Native American to fly in space. He is an enrolled member of the Chickasaw Nation.</p> <p><u>6th &amp; 7th SHUTTLE CREWMEMBER REPLACEMENTS</u><br/>- Gus Loria was replaced by Lockhart in Aug. 2002 and Don Thomas (to join EXP 6) by Pettit in Jul. 2002 - both due to medical issues. (Fifth Shuttle crewmember replacement occurred on STS-98.)</p> <p><u>FLIGHT DURATION CHANGES:</u> Extended flight 3 days total.<br/>- EOM - Planned landing at KSC on orbit 170 (Tig orbit 169) at 338:20:49Z, 3:49 PM EST on Wednesday, December 4, 2002. Waved-off landing on orbit 170 (Tig orbit 169) at Tig-21 minutes due to NO GO forecast for ceiling (broken 6000 feet). Weather reported that at landing time ceiling was 8000 feet and showers at 30 nm (GO Observation).<br/>- Waved-off landing on orbit 171 (Tig orbit 170) at Tig -24 minutes due to NO GO Forecast of ceiling 6500 feet. (One day extension) waveoff 1 day. Landing observations verified NO GO (BKN 6500 feet).<br/>- EOM+1 - Waved-off landing at KSC on orbit 185 (Tig orbit 184) at 339:19:54Z, 2:54 PM EST on Thursday, December 5, 2002 at approximately Tig-3H15M due to observed 18 knot crosswinds, moisture within 30 nm and broken 7000 feet.<br/>- Waved-off landing at KSC on orbit 186 (Tig orbit 185) a few minutes later for crosswind, moisture, and ceiling violations. (Second day Extension) waveoff 2 days.<br/>- EOM+2 - Waved-off landing at KSC on orbit 200 at 340:18:57Z, 1:57 PM EST on Friday, December 6, 2002 at Tig-3H03M due to NO GO forecast and observed drizzle at SLF and overcast 900 ft.<br/>- Decided to proceed with Deorbit Prep for orbit 201 landing but not fluid load. Closed the PLBD's and gave GO for OPS 3 transition. Weather violations continued. Waved-off landing at Tig-1H12M due to continued NO GO observed and forecast drizzle/fog, visibility 3 miles and overcast 600 feet. (Third Day Extension) waveoff 3 days.<br/>- EOM+3 - Landed at KSC Runway 33 on orbit 216 at 341:19:37:13Z, 2:37:13 PM EST, Saturday, December 7, 2002 (MET 13:18:47:26). Total extensions 3 Days (Record for three days extension due to weather, landed on EOM+4). STS-57 was extended 3 days; however, the first day extension was for science and the last 2 days were weather extensions. Record minimum crossrange of 2.1 miles</p> <p>Continued...</p> |



S113E05230

## --- THREE UP (EXP 6) THREE DOWN (EXP 5) ---


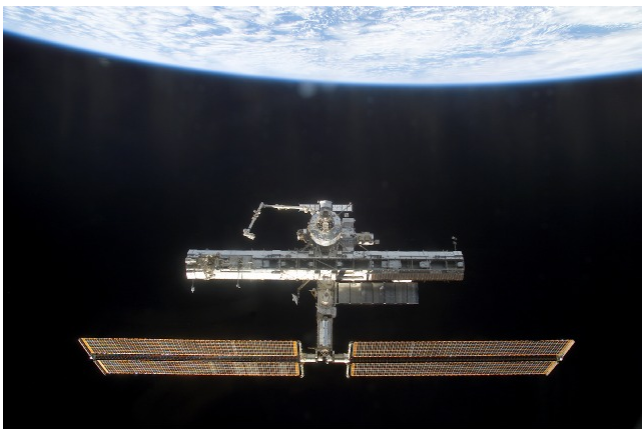
STS113-E-05230 (29 November 2002) --- The STS-113 (red shirts), Expedition Five (right) and Expedition Six crewmembers (left) gathered for a group photo in the Destiny laboratory on the ISS. The STS-113 crew, front to back, are astronauts James D. Wetherbee, Mission Commander; John B. Herrington (left), Michael E. Lopez-Alegria, Mission Specialists; and Paul S. Lockhart, Pilot. The Expedition Six crew, front to back, are astronauts Kenneth D. Bowersox, Commander; Donald R. Pettit, NASA ISS Science Officer; and cosmonaut Nikolai M. Budarin, Flight Engineer. The Expedition Five crew, front to back, are cosmonaut Valery G. Korzun, Commander; astronaut Peggy A. Whitson, NASA ISS Science Officer; and cosmonaut Sergei Y. Treschev, Flight Engineer. Korzun, Treschev, and Budarin represent Rosaviakosmos.





# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-156 - STS-113/11A

| FLT NO.   | ORBITER  | CREW<br>7 UP/7 DOWN<br><br>TITLE, NAMES<br>& EVA'S                                | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br><br>AND<br>ET | ORBIT<br><br>INC<br><br>HA/HP | FSW | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXP | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|--|---|--|---|---|------------------------------|-------------------------------|-----|---|--|
| STS-113/<br>ISS 11A<br><br>Continued...   | STS113-714-<br>039 --- John<br>B. Herrington<br>(left) and<br>Michael E.<br>Lopez-Alegria<br>s, work on<br>the newly<br>installed Port<br>One (P1)<br>truss. |  |  |   |   |                              |                               |     |   | <p>Continued...</p> <p><b>RENDEZVOUS #61:</b><br/>- Rendezvous and Dock with ISS (PMA2 Lab Fwd Port).</p> <p><b>SHUTTLE NIGHT LAUNCH #28:</b></p> <p><b>EVENTS:</b><br/>- NCT1 maneuver at 328:03:42:05Z (02:52:28 MET) resultant altitude of 170.2 by 186.7 nm.<br/>- MC4 maneuver at 329:20:27Z (01:19:37 MET) resultant altitude 203.3 by 215.5 nm.<br/>- ISS Capture (PMA 2 Lab Fwd Port) at 329:21:20:27Z (01:21:08:53 MET)<br/>- ISS Hard dock at 329:22:10:49Z (01:21:21:02 MET)<br/>- ODS Upper Hatch Open (all hatches open) at 329:23:29:47Z (01:22:40 MET)<br/>- IELK S/L Transfer (Official transfer of ISS from Expedition 5 Crew to Expedition 6 Crew) at 330:02:28Z (02:01:39:13 MET)<br/>- SRMS unberth of P1 ITS at 330:15:19:51Z (02:14:30 MET) and positioned P1 over orbiter Port Wing for handoff to SSRMS. (Thereafter SRMS camera was used only for video support of EVA activities.)<br/>- SSRMS used to mate P1 ITS to S0 truss at 330:18:50:14Z (02:18:00:27 MET)<br/>- EVA 1 Start at 330:19:48Z (02:18:57 MET), EVA 1 End at 331:02:33Z (03:01:43 MET) on November 26, 2002, duration 6H45M. All three EVA's used Pre-Breathe Protocol while exercising on Shuttle Ergometer located in mid-deck. Crew had to use Shuttle Ergometer as the CEVAS had a problem. Made connections between P1 and S0 Trusses. Released launch restraints on CETA Cart, DLA, and TARJ Stinger, installed Node 1 WETA.<br/>- Reboost 1 at 331:17:10:47Z (03:16:21 MET) delta V + 2.4 fps, altitude increase 2.4 nm, altitude 216 by 207 nm.<br/>- EVA 2 Start at 332:18:36Z (04:17:46 MET), EVA 2 End at 333:00:47Z (04:23:57 MET) on November 28, 2002, duration 6H10M. Installed fluid jumpers between P1 &amp; S0. Removed P1 Port &amp; Stbd keel pins. Installed WVS TX Assy on P1. Relocated CETA Cart from P1 to S1. Released P1/P3 line clamps. Removed &amp; stowed Radiator beam launch locks.<br/>- Reboost 2 at 333:16:50:59Z (05:16:01:12 MET), delta V = 2.56 fps, altitude increase 0.7 nm, altitude 216 by 209 nm.<br/>- EVA 3 Start at 334:19:24Z (06:18:34 MET) and End at 335:02:24Z (07:01:34 MET) on November 30, 2002, duration 7H00M. Installed Z1/P6/Lab, Lab HX, and P1 RBVM SPD's. Reconfigured electrical harnesses, route power through Main Bus switching units.<br/>- Reboost 3 at 335:16:36:47Z (07:15:49 MET), delta V = 8.6 fps, altitude increase 2.4 nm, final orbit 216.6 by 211.4 nm.<br/>- Farewell 336:17:18Z (08:16:28 MET)<br/>- ODS Upper Hatch closed at 336:17:47:47Z (08:16:58 MET), Lab Fwd Hatch (all hatches closed) closed at 336:18:15:47Z (08:17:26 MET)<br/>- Undocking complete at 336:20:04:50Z (08:19:15:03 MET)<br/>- Transfers: Shuttle to ISS 2160 lbs plus P1 ITS of 27514 lbs, 690 lbs H<sub>2</sub>O (672 lbs in 7 CWC's and 18 lbs in one PWR), 32 lbs O<sub>2</sub> used during prebreathe for 3 EVA's. Plus 6 LiOH cans. Transfer ISS to Shuttle 2250 lbs.<br/>- MEPSI deploy at approx. 336:22:25Z (08:21:36 MET)</p> |
|  |  |   |  |   |   |                              |                               |     |   | <p>STS-113-E-05433 (2 December 2002) --- The ISS post undocking of Endeavour as the two spacecraft flew over northwestern Australia. The newly installed Port One (P1) truss now complements the Starboard One (S1) truss in center frame.</p>   |
|   |  |   |  |   |   |                              |                               |     |   | <p>JSC2002-01994 --- The Ascent/Entry FCT pose for group portrait in the shuttle flight control room (WFCR) in Houston's MCC. Ascent/Entry Flight Director Wayne Hale is in center front row.</p>  |

## Page 2-157 - STS-107

[illegible]



## Page 2-158 - STS-107

| FLT NO.   | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, | LANDING SITE/ RUNWAY, CROSSRANGE | SSME-TL NOM-ABORT EMERG | SRB RSRM | ORBIT |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------|---|----------------------------|----------------------------------|-------------------------|----------|-------|--|-----|---|---|
| STS-107<br><br>Continued...   |         | <p><b>CAIB REPORT:</b><br/>Accident Analysis indicated that the physical cause of the loss of Columbia and its crew was a breach in the Thermal Protection System on the leading edge of the left wing. The breach was initiated by a piece of insulating foam that separated from the left bipod ramp area of the External Tank and struck the wing in the vicinity of the lower half of Reinforced Carbon-Carbon panel 8 at 81.9 seconds after launch. During re-entry, this breach in the Thermal Protection System allowed superheated air to penetrate the leading-edge insulation and progressively melt the aluminum structure of the left wing, resulting in a weakening of the structure until increasing aerodynamic forces caused loss of control, failure of the left wing, and breakup of the Orbiter.</p> |                            |                                  |                         |          |       |  |     |   | <p>Continued...</p> <p><b>FLIGHT DURATION CHANGES:</b> (continued) time. Communications and tracking were lost at an altitude of approximately 203,000 feet while Columbia was traveling at approximately 12,500 miles per hour at Mach 18. - Columbia and 7 astronauts were lost over Texas.</p> <p><b>RED SHIFT:</b> Rick Husband, Kalpana Chawla, Laurel Clark, Ilan Ramon.</p> <p><b>BLUE SHIFT:</b> William McCool, David Brown, Michael Anderson (PL CDR)</p> <p><b>STS-107 EVENTS:</b><br/>Orbital Altitude was 150 nm.</p> <p><b>STS-107 FLIGHT OBJECTIVES/EXPERIMENTS:</b><br/>- Flight was a dedicated and successful science/research mission.<br/>- Primary payload is SPACEHAB Research Double Module (SHRDM) with International, NASA and SPACEHAB commercial payloads including Life Sciences, Materials, and Microgravity Science Research Experiments.<br/>- Fast Reacting Experiments Enabling Science, Technology, Applications and Research (FREESTAR) is a complex Secondary Payload which is a cross bay carrier with following payloads: MEIDEX (Mediterranean Israeli Dust Experiment), Solar Constant-3 (SOLCON-3), Shuttle Ozone Limb Sounding Experiment-2 (SOLSE-2), Critical Viscosity of Xenon-2 (CVX-2), Low Power Transceiver (LPT), and Space Experiment Module-14 (SEM-14)<br/>- Ram Burn Observation (RAMBO)</p> <p><b>SIGNIFICANT ANOMALIES:</b><br/>- ET Foam loss during ascent at approximately 81 seconds (likely from Bi-pod area) (IFA). Re-design constraint to flight.<br/>- RSRM Nozzle Flex Boot Separation (IFA). Constraint to flight.<br/>- O<sub>2</sub> Tank 7 Heater failed off in Manual Mode (IFA STS-107-V-02)<br/>- Suspected Fuel Cell Monitoring System Data Cable problem. FCMS is suspect after same problem with backup cable.<br/>- SM I/O Errors on IP Bus<br/>- DSR 20 Error Message 32 (Loss of tape recording and playback)<br/>- 70 mm Hasselblad Intermittent Motor Drive (Binds or jams)<br/>- 2nd 70 mm Hasselblad Motor Jam<br/>- STGT site outage<br/>- Payload No I-COM B Transmission in Spacehab (Not being heard in Spacehab)<br/>- Spacehab water loop Degradation (Flow rates decreasing)<br/>- Payload Ku Channel 2 Data Dropouts (Ku-Band and S-Band)<br/>- AC2 Phase B "Sluggish" Current Signature on Orbiter (IFA STS-107-V-01)<br/>- Forward DAP Auto A Contact Deselected by RM<br/>- Spacehab Rotary Separator flooding short<br/>- Loss of Columbia and crew during Entry - IFA STS-107-V-03</p> |
| <p><b>Shuttle Legacy Mural - Hanging in LCC Firing Room at KSC</b></p>  <p><b>COLUMBIA TRIBUTE</b><br/>By Mike Leinbach/Launch Director &amp; Amy Simpson/KSC PH-2, May 2010</p>   |         |   |                            |                                  |                         |          |       |  |     |   |   |
| <p>The STS 107 crew is shown on-orbit in SPACEHAB research module aboard Columbia. From left (bottom row) wearing red shirts to signify their work shift color, are Kalpana Chawla/MS2, CDR Rick D. Husband, Laurel B. Clark/MS4, and Ilan Ramon/PS1 (Israel). From left (top row), wearing blue shirts, are David C. Brown/MS1, PLT William C. McCool, and Michael P. Anderson/PL-CDR.</p>  <p><b>IN MEMORIAM</b></p>  |         |   |                            |                                  |                         |          |       |  |     |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY



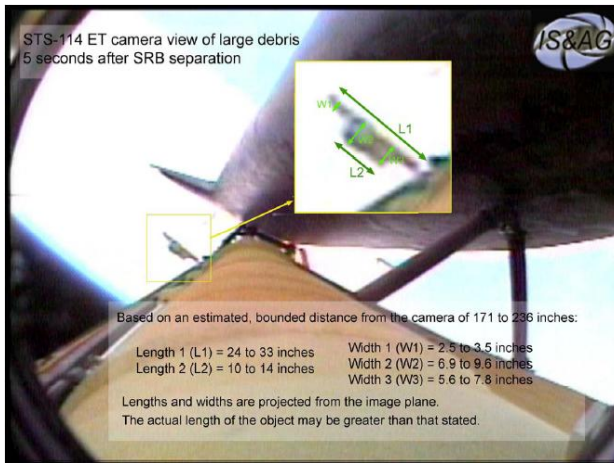
Page 2-159 - STS-114/LF-1

| FLT NO.  | ORBITER  | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET   | ORBIT   |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|---|---|---|---|---|---|---|--|--|---|
| STS-114/LF-1<br><br>SEQ FLT #114<br>KSC-114<br>PAD 39B-50<br>MLP-3<br>17TH SHUTTLE FLIGHT TO ISS<br>ISS LOGISTICS FLIGHT 1 | OV-103 (Flight 31)<br><br>Discovery<br><br>OMS PODS: LPO1-34 RPO3-32 FRC3-31 | CDR: Eileen Collins (Flt 4 - STS-63, STS-84, STS-93) P697/R188/V139/F24<br><br>PLT: James M. Kelly (Flt 2 - STS-102) P698/R263/V180/M229<br><br>M/S 1/EV-1: Soichi Noguchi (Japan JAXA) P699/R294/M257<br><br>M/S 2/EV-2: Stephen K. Robinson (Flt 3 - STS-85, STS-95) P700/R222/V152/M196<br><br>M/S 3: Andrew S.W. Thomas (Flt 4 - STS-77, Up to Mir on STS-89, Down on STS-91, STS-102) P701/R213/V149/M186<br><br>M/S 4: Wendy B. Lawrence (Flt 4 - STS-67, STS-86, STS-91) P702/R192/V146/F25<br><br>M/S 5: Charles Camarda P703/R295/M258<br><br>SS EVA 89 EMU/TETHERED EVA 82 SCHEDULED EVA 83 DURATION 6:50<br><br>SS EVA 90 EMU/TETHERED EVA 83 SCHEDULED EVA 84 DURATION 7:14<br><br>SS EVA 91 EMU/TETHERED EVA 84 SCHEDULED EVA 85 DURATION 6:01<br><br>Continued... | KSC 39B 207:14:39:00Z 10:14:39 AM EDT (P) 10:39:00 AM EDT (A) Tuesday 14 7/26/05 (8)<br><br>LAUNCH WINDOW: 4M52S (In-Plane Time) with ISS<br><br>EOM/PLS: KSC TAL: ZZA TAL WX: MRN, FMI<br><br>SELECTED: RTLS: KSC 33/N/N TAL: ZZA 30/N/SFD AOA: KSC 33/N/N PLS: EDW 22/N/SFD<br><br>TDEL: 0.02 -0.178<br>MAX Q NAV: 775 709<br>SRB STG: 122.4 126.76<br>PERF: NOMINAL:<br>2 ENG TAL (ZZA): 2:43 2:44<br>NEG RETURN: 3:52 3:57<br>PTA (U/S 182): 5:10 5:14<br>SE TAL (ZZA 104): 6:09 6:14<br>PTM (U/S 614): 6:10 6:14<br>SE PRESS 104: 6:57 7:02<br>MECO CMD: 8:24.2 8:24.9<br>VI: 25819 25819.6<br>OMS-2: 37:40 38:00 100.7 FPS 99 FPS | EDW 22, CONC EDW 50, CONC 31 221:12:11:23Z 5:11:23 AM PDT Tuesday 21 8/9/05 (7)<br><br>DEORBIT BURN: 221:11:06:18Z<br>X RANGE: 46 NM<br>ORBIT DIR: AL 33<br>AIM PT: NOM<br>MLGTD: 1311 FT 221:12:11:23Z<br>VEL: 226 KGS 222 KEAS<br>HDOT: -5.5 FPS<br>TD NORM 205: 2761 FT<br>DRAG CHUTE DEPLOY: 192 KEAS 221:12:11:31.9Z<br>NLGTD: 6573 FT 221:12:11:38Z<br>VEL: 163 KGS 156 KEAS<br>HDOT: -6.4 FPS<br>BRK INIT: 90 KGS<br>DRAG CHUTE JETTISON: 53 KGS 221:12:12:08Z<br>BRK DECEL FPS: AVE 5.1 PK 6.6<br>WHEELS STOP: 221:12:12:31Z 12657 FT<br>ROLLOUT: 11346 FT 68 SEC<br>NO BLACKOUT DURING ENTRY<br>Continued... | 104/104/109%<br><br>PREDICTED: 100/104.5/104.5/ 72/104.5<br><br>ACTUAL: 100/104.5/104.5/ 72/104.5<br>1 = 2057 (1)<br>2 = 2054 (5)<br>3 = 2056 (3)<br><br>ALL BLOCK II ENGINES | BI-125 RSRM-92<br>ET-121<br>SLWT-22<br><br>ET<br>IMPACT: 1:14:10 MET<br><br>LAT: 36.56°S<br>LONG: 158.7°E | 51.60 (17)<br>DIRECT INSERTION<br><br>POST-OMS-2 123.6 NM X 85.0 NM | OI-30 (1)<br>CARGO: 38652 LBS<br>PAYLOAD CHARGEABLE: 29807 LBS<br>DEPLOYED: 26413 LBS<br>NON-DEPLOYED: 3231 LBS<br>MIDDECK: 163 LBS<br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1216135 LBS<br>NON-DEPLOYED: 1562948 LBS<br>CARGO TOTAL: 3585860 LBS<br>PERFORMANCE MARGINS (LBS): FPR: 3098 FUEL BIAS: 1269 FINAL TDDP: 2111 RECON: 3792<br>PAYLOADS: PLB: ISS LF-1 MPLM RAFFAELLO, ESP2, LMC, RMS, ODS, OBSS<br>MIDDECK: ISS LF-1 RAMBO<br>5 CRYO TK SETS 6 GN2 TANKS<br>RMS 71<br>RMS USED FOR TPS SURVEYS AND TWO GAP FILLER REMOVALS | <b>Brief Mission Summary:</b> With STS-114/LF-1 (17 <sup>th</sup> ISS mission), NASA initiated Return to Flight 2 years after the Columbia accident. The crew was charged with a busy to-do list that included testing new safety techniques and delivering much-needed supplies to ISS.<br>KSC/WD: OPF 994, VAB 25, PAD 85 = 1104 days total<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline OV-104 Atlantis as ULF-1 Crew Rotation flight with launch date of 1/16/03 on 12/6/01<br>- Postponed launch date to NET 3/1/03 on 9/16/02. Postponement caused by Engine Flowliner cracks.<br>- Subsequent postponements after STS-107 Accident to NET 7/21/03, NET 10/1/03, NET 12/18/03, NET 3/11/04, NET 9/12/04.<br>- Postponed launch date to NET 3/6/05 on 3/22/04. Changed flight to ISS Logistics Flight LF-1, canceled crew rotation, and changed orbiters to Discovery OV-103.<br>- Tanking Test 1 on 4/24/05 experienced two intermittent LH2 ECO anomalies. (ECO sensors #3 & #4 failed WET). Replaced MPS Point Sensor Box (PSB) and all Sensor #3 & #4 wiring to LH2 monoball. Subsequent to completion of this work, the Tanking Test #2 LH2 Sensor performance was nominal.<br>- Postponed launch date to NET 5/12/05, 5/15/05, 5/22/05, 7/13/05<br>- Rolled back from pad 39B to VAB on 5/26/05 to swap stacks with STS-121, due to a late all-flights requirement for a heater on the ET LO <sub>2</sub> Feedline upper bellows, to prevent formation of critical ascent ice debris in that area. Installation of the bellows heater was started on ET-121 (STS-114 was ET-120) in the VAB before the STS-114 stack was rolled-back. Removed and replaced an out-of-spec H <sub>2</sub> diffuser.<br>- Replaced MPS PSB after a power card failure.<br>- Rolled out to Pad 39B on 06/15/05 and set launch date of 07/13/05 on 05/22/05.<br><br>LAUNCH SCRUBS:<br>- Scrubbed 07/13/05 launch attempt at 194:17:30Z (L-2:14:51 to Window Opening) when LH <sub>2</sub> ECO Sensor #2 failed WET (failed to transition to DRY with Sim Commands). This violated OMRSD and LCC MPS-22 requirements for four functional LH <sub>2</sub> sensors. Extensive tests were conducted that identified a degraded PSB ground and some evidence of EMI as potential causes of the false WET problem. At MMT on 07/20/05, decided to set launch for 07/26/05 (without a special tanking test), allowing sufficient time to clean up the ground and EMI. Decision was made to perform ECO Sensor #2 and #4 pin swap that provides additional troubleshoot results. (Note: ECO sensors operated normally on 7/26/05; further analyses and tests have significantly reduced the concerns about PSB grounding and EMI as causes of the STS-114 anomalies, but this remains a UA as of February 2006).<br>- Weather: All three TAL sites were forecast and observed GO. RTLS and AOA1 landing site KSC was forecast NO GO for precipitation and thunderstorms within 20 NM and observed NO GO for thunderstorms within 20 NM (Anvil). 07/13/05 Launch Attempt was a combined Technical/Weather Scrub.<br><br>LAUNCH WINDOW:<br>Window opened at 207:14:34:33Z and closed at 207:14:43:52Z for a total window of 9M19S. The Preferred Launch Time (In-Plane Time) was 207:14:39:00Z resulting in a Launch Window of 4M52S.<br>Continued... |  |   |



JSC2005-E-16245 (April 2005) --- Art panel for STS-114 Return to Flight - Features Shuttle, ISS Assembly, crew patch, first step for humans return to the Moon, and onward to Mars & beyond.




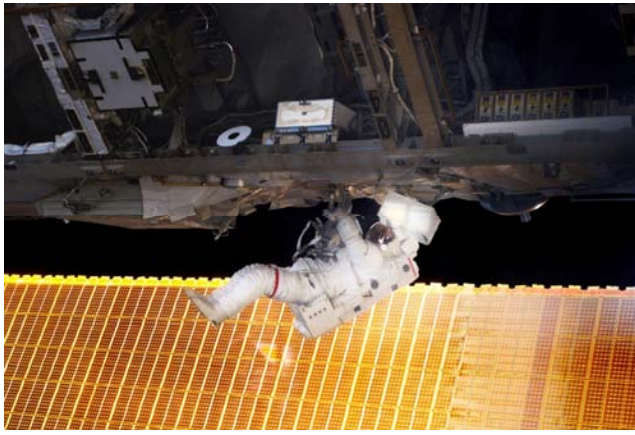
## Page 2-160 - STS-114/LF-1

| FLT NO.   | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.                                 | SRB RSRM AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |   |  |
|---|---------|--|---|---|--|-----------------|-------|--|-----|--|---|---|--|
| STS-114/LF-1<br><br>Continued...  |         | Continued...<br><br>MCC WHITE FCR (44)<br><br><u>FLIGHT DIRECTORS:</u><br><br>SHUTTLE:<br>A/E - LeRoy Cain<br>LD/O 1 - Paul Hill<br>O 2 - Anthony Ceccacci<br>O 3/PIng - Catherine Koerner<br>Team 4 - Kelly Beck<br>WX - Steven Stich<br>MOD - Phil Engelauf<br><br>ISS:<br>LD/O 2 - Mark Ferring<br>O 1 - Bryan Lunney<br>O 3/PIng - Joel Montalbano<br>Team 4 - Richard LaBrode |   | Continued...<br><br><u>DENS ALT:</u> 3799 FT<br><br><u>FLT DURATION:</u> 13:21:32:23<br><br><u>S/T:</u> 1045:09:27:05<br><br><u>OV-103:</u> 255:20:12:58<br><br><u>DISTANCE:</u> 5,796,419 sm |  |                 |       |  |     | Continued...<br><br><u>LAUNCH DELAYS:</u><br>None. Launch occurred at 207:14:39:00Z, 10:39:00 AM EDT on Tuesday, 07/26/05.<br><br><u>TAL WX:</u><br>Zaragoza (Primary and Selected) was forecast and observed GO. Moron was forecast and observed NO GO for Crosswind. FMI (Istres) was forecast GO but observed NO GO for Tailwind violation.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Standard Set plus: (1) PE Operational High Q SUM/JUL, (2) OMS Assist, (3) 52 NM MECO, (4) Del Psi<br><br><u>FLIGHT DURATION CHANGES:</u><br>- On Flight Day 4, decision made to extend flight 1 day to give more time to transfer activities to and from ISS. EOM Day: Deorbit Tig on Orbit 201 was at 220:07:43Z and landing time at KSC on Orbit 202 at 12/18:07 MET 220:08:46Z (4:46 AM EDT). EDW was not called up for support on EOM day.<br><br>- Early weather forecast was GO except for a chance of showers. Gave crew a GO for PLBD closure at 220:05:15Z. Light rain was observed at SLF for a few minutes. At 220:06:15Z gave crew a GO for fluid loading. Last forecast changed to NO GO at 220:0643Z with observed broken low clouds at 1000 feet in SLF area. At 220:07:16Z, due to low clouds, decision was made to wave off first opportunity at KSC. KSC was observed GO at landing time. Flight extension 1 day plus one orbit. KSC opportunity 2 Deorbit Tig on Orbit 202 was at 220:09:19Z and landing time at KSC was 220:10:22Z (5:42 AM CDT). Last forecast at 220:08:46Z was GO. However, due to unstable conditions in low clouds, FD made decision to wave off landing at KSC on second opportunity. KSC was observed NO GO due to precipitation in SLF area. Flight extension now 2 days.<br><br>- EOM + 1 Day: All three EOM landing sites KSC, EDW, and NOR were called up on pick-em day with Discovery landing at one of the three sites. First opportunity for a KSC landing was on Orbit 218 at 221:09:08Z with Tig at 220:08:05Z on Orbit 217. Gave a GO for PLBD closing at 221:05:05Z but did not give a GO for crew fluid loading. Weather was NO GO with showers, thunderstorms, and confirmed electrified cloud within 30 NM. Showers and thunderstorms were forecast within 30 NM at landing time. At 221:06:55Z, waved off landing at KSC on Orbit 218. Flight extensions 2 days + one orbit.<br><br>- Changed Landing site to EDW. Targeted landing at KSC on Orbit 219 at 221:10:43Z. Gave crew a GO to fluid load at 221:08:40Z. At 221:08:43Z, weather forecaster reported two cells developing rapidly northeast of field moving NE with lightning in a northeast cell. At 221:08:57Z, Crew reported APU prestart complete. Current observations at SLF had showers within 30 NM with electrified cirrus (anvil) within 30 NM with forecast of thunderstorms within 30 NM moving NE. At 221:09:00, Flight Director advised crew to stop fluid loading. Waved off landing at KSC on Orbit 219, the last opportunity on FD 13. Decision made to change landing sites to EDW concrete runway 22 on Orbit 220. Flight extensions 2 days + two orbits. |   |   |  |
|   |         |  |   |   |  |                 |       |  |     |  |   |  |  |
| First use of the 50-foot-long robotic arm known as Orbiter Boom Sensor System (OBSS) equipped with laser imager and cameras to inspect for ascent damage of Wing Leading Edges RCC and Shuttle Bottom Tiles during approach and docking with ISS. |         |  |   |   |  |                 |       |  |     |  |   | From MMT Brief of IFA: "ET TPS Foam Loss During Ascent – Constraint to next flight" |  |







# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-161 - STS-114/LF-1

| FLT NO.                          | ORBITER  | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|----------------------------------|--|---|---|--|--|------------------------|------------------------|--|-----|---|---|
| STS-114/LF-1<br><br>Continued... |  | <div>JSC2004-E-01407</div> <div></div> <div>CDR Collins</div> <div>Discovery was about 600 ft from ISS when CDR Collins performed the first R-Bar (back-flip) maneuver to allow inspection of the vehicle heat shield. Photos were analyzed on the ground to assess any damage during ascent. (Photos shown top to bottom are: iss011e11255, iss011e11257, Iss011e11260, iss011e11263, Iss011e11270)</div> |   |  |  |                        |                        |  |     | <div>Continued...</div> <div>Targeted landing at EDW on orbit 220. Discovery landed with MLGTD at EDW 22 at 221:12:11:23Z, 13:22:32:23 MET, 5:11:23 AM PDT on August 9, 2005. NLGTD was at 221:12:11:38Z.</div> <div>FIRSTS/LASTS:</div> <div><ul style="list-style-type: none"><li>- First flight in Return-To-Flight after Columbia STS-107.</li><li>- First launch in 922 days after STS-107 launch.</li><li>- First flight with Istres, France as a TAL site.</li><li>- First flight with ET bipod redesign to eliminate large insulating foam ramps as a debris source and replace them with electric heaters.</li><li>- First use of the 50-foot-long robotic arm extension known as Orbiter Boom Sensor System (OBSS) equipped with Laser Imager and cameras to inspect Wing Leading Edges RCC and the Shuttle Bottom tiles for damage.</li><li>- First use of upgraded Ground Camera Ascent Imagery System, two WB-57 aircraft based video, and ship and ground based radar.</li><li>- First use of WLE instrumentation behind RCC panels to gather and downlink acceleration and temperature data during ascent phase.</li><li>- First use of orbiter back-flip pirouette (R-bar pitch maneuver) to allow ISS based photography of orbiter bottom TPS.</li><li>- First EVA crew to make repairs on shuttle bottom. Removed gap fillers protruding approximately 1 inch from black tiles in two areas of orbiter bottom black tiles, each extended approximately 1 inch. Gap fillers were removed during EVA 3.</li><li>- First flight with ET design change to use heater in bipod ramp area to prevent ice/frost buildup (in lieu of insulating foam in that area).</li><li>- Mandated day-time launch for STS-114 and STS-121 to provide proper lighting for video and film cameras observation of ET debris shedding during ascent.</li><li>- First flight with ET LOX Feedline upper bellows heater to prevent formation of critical ascent ice debris in that area.</li></ul></div> <div>EVENTS:</div> <div><ul style="list-style-type: none"><li>- ET Separation at 207:14:47:00Z, 8:46 GET</li><li>- MC-1 maneuver at 01:17:37:53, delta V 0.44 ft/sec Orbit 199.7 by 213.1 NM</li><li>- FD2 SRMS/OBSS survey of Wing Leading Edges and nose cap</li><li>- FD2 SRMS survey of orbiter upper surfaces</li><li>- ISS capture at 209:11:17:20Z (01:20:38:20 MET)</li><li>- Hard Dock: 209:11:31:53Z (01:20:52:53 MET)</li><li>- Open Lab Fwd Hatch at 209:11:51:00Z (01:21:12 MET)</li><li>- Open APAS Hatch at 209:12:35:00Z (01:21:56:00 MET)</li><li>- Open ODS Hatch at 209:12:14:00Z (01:22:14 MET) ISS ingress</li><li>- FD4 OBSS survey of heat-protection tiles. MPLM docked to Node 1. MPLM and Middeck transfers begin.</li><li>- EVA 1 start at 211:09:45:50Z, 3:19:06:50 MET, duration 6H50M, on 07/30/05. Crew members performed EWA &amp; NOAX TPS sample repair DTO 848 in PLB. Crew used OBSS to scan pre-damaged RCC samples on DTO pallet.</li></ul></div> <div>Continued...</div> |   |
|                                  |  |   |   |  |  |                        |                        |  |     | <div></div> <div>S114-E-6751 (2 August 2005) --- Crew portrait in Destiny Lab. From left (front row) are Thomas/MS, CDR Collins, &amp; Noguchi/MS (JAXA). From left (back row) are PLT Kelly, Camarda/MS, Robinson/MS, &amp; Lawrence/MS.</div>   |   |
|                                  |  |   |   |  |  |                        |                        |  |     | <div></div> <div>S114-E-6062 --- Noguchi (JAXA) participates in Mission's first EVA demonstrating Shuttle thermal protection repair techniques.</div>  |   |







# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER   | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.  | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|--------------------------------------|---|---|--|------------------------|------------------------|--|-----|---|---|
| STS-114/LF-1<br><br>Continued...  |  |                                      |   |   | Continued...<br><br><u>EVENTS</u> (Continued):<br>- EVA 2 start at 213:08:43:00, 5:18:04:00 MET, duration 7H14M on 08/01/05. EVA crew removed, replaced, and performed checkout of ISS CMG 1. Crew started CMG 1.<br>- EVA 3 start at 215:08:48:00Z, 7:18:09:00 MET, duration 6H01M, on 08/03/05. Installed External Stowage Platform (ESP-2) on ISS airlock. Removed gap filler material (two) protruding from orbiter bottom tiles.<br>- Orbiter undocked from ISS at 218:07:23:45Z (10:16:44:45 MET)<br>- Total Consumables transferred to ISS 1855.2 lbm (18 CWC's & 5 PWR's), N <sub>2</sub> = 29 lbm tank-to-tank; Stack-to-stack O <sub>2</sub> = 60.85 lbm (27.6 lbm atmo & 33.3 metabolic), N <sub>2</sub> to ISS cabin transfer = -7.7 lbm.<br>- Total MPLM transfers to ISS 3695 lbs (2095 Cargo and 1600 HRF). 6600 lbs transferred to MPLM/Discovery for return to earth<br>- ISS Visitor Time was 8D19H51M52S (Hard dock to Undock)<br>- Sep 1 Burn at 218:08:36:26Z Ha 193.5 Hp 189.3, Sep Burn 2 at 218:09:04:26Z Ha 194.1 Hp 168.1 NM<br>- Orbit Adjust Burn at 221:11:06:18Z H<br><br><u>RENDEZVOUS # 62:</u> Rendezvous and dock with ISS.<br><br>SPACE SHUTTLE NIGHT LANDING: # 20 total and sixth night landing at EDW.<br><br><u>SIGNIFICANT ANOMALIES:</u><br>- LH <sub>2</sub> ECO sensor #2 stayed wet when commanded dry caused launch scrub.<br>- ET TPS damages and TPS foam losses during ascent constraint to next flight:<br>- LH <sub>2</sub> PAL ramp, Ice/Frost ramp, Acreage, Intertank flange foam losses.<br>- +Y thrust strut flange and -Y Bipod spindle closeout foam losses.<br>- TPS Blanket damage near window 1<br>- TPS Gap Filler Protruberances (removed during EVA 3)<br>- Nose Landing Gear TPS tile damage<br>- APU 2 momentary loss of Press & Temp Indications<br>- ODS Capture Latch manual release talkback showed "Open" prior to hooks drive<br>- Airlock Aft "B" Hatch Closure difficulties<br>- Airlock Depress Off-Nominal<br>- TCS repeated loss of Track<br>- VRCS thruster R5R Low Pc. Heater may have failed on.<br>- MPS/SSME low pressure helium decay rate exceeded<br>- WSB GN <sub>2</sub> Regulator outlet pressure low<br>- High O <sub>2</sub> concentration in aft compartment during ascent<br>- Loss of several Orbiter tile putty repairs during ascent<br>- Late release of two FRCS Thruster TYVEK rain covers during ascent<br>- Orbiter forward ET attach point NSI pyro bolt ejection after nominal NSI firing |                        |                        |  |     |   |   |
|   |   |                                      |    |   |  |                        |                        |  |     |   |   |
| JSC2004-E-45140 ---Lead Flight Director Paul Hill (foreground) and CAPCOM Stephen N. Frick monitor communications in the Shuttle Flight Control Room (WFCR) in JSC MCC with the STS-114 crewmembers during a fully-integrated - simulation - one of many to establish readiness for Return to Flight. |   |                                      | S114-E-6642 --- Robinson anchored to a foot restraint on ISS Canadarm2, participates in the mission's third EVA which included removal of two gap fillers protruding from orbiter bottom tiles.<br><br>JSC2005-E-32538 (5 August 2005) --- U.S. Senator Kay Bailey Hutchison (R.-Texas) and U.S. Representative Tom DeLay (R.-Texas) talk to CDR Eileen M. Collins aboard Discovery. Looking on are NASA Administrator Mike Griffin (left) and Flight Director Jeff Hanley. |   |  |                        |                        |  |     |   |   |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-163 - STS-121/ULF1.1

| FLT NO.   | ORBITER   | CREW<br>(7 up, 6 down)<br><br>TITLE, NAMES<br>& EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br><br>AND<br>ET   | ORBIT   |   | FSW | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|--|--|--|--|--|---|---|-----|---|--|
| STS-121/<br>ULF1.1<br><br>SEQ<br>FLT# 115<br><br>KSC 115<br><br>PAD 39B-51<br><br>MLP-1<br>18th Shuttle<br>Flight to ISS<br><br>ISS Logistics<br>Flight 2 | OV-103<br>(Flight 32)<br>Discovery<br><br>OMS PODS:<br>LPO1-27<br>RPO3-34<br>FRC3-32<br><br>PLT:<br>Mark E. Kelly<br>(Flt 2 (STS-108))<br>P705/R271/V181/M237<br><br>EV2/M/S 1 (PAYLOAD CDR):<br>Michael E. Fossum<br>P706/R296/M259<br><br>M/S 2:<br>Lisa M. Nowak<br>P707/R297/F38<br><br>M/S 3:<br>Stephanie D. Wilson<br>P708/R298/F39<br><br>EV1/M/S 4:<br>Piers J. Sellers<br>(Flt 2 (STS-112))<br>P709/R285/V182/M249<br><br>M/S 5 UP, stay as ISS EXP<br>13 FE:<br>Thomas Reiter<br>P710/R299/M260<br>(ESA - Germany) | KSC 39B<br>185:18:37:55 Z<br>2:37:55 PM EDT (P)<br>2:37:55 PM EDT (A)<br>Tuesday 15<br>7/4/06 (9)<br><br>LAUNCH WINDOW:<br>3M43S (In-plane time<br>with ISS)<br><br>EOM PLS: KSC<br>TAL: MRN<br>TAL WX: ZZA, FMI<br><br>SELECTED:<br>RTLS: KSC 33/N/N<br>TAL: MRN 20/C/I/N<br>AOA: KSC 15/N/N<br>PLS: EDW 22/N/N<br><br>TDEL:<br>0:09 .172<br><br>MAX Q NAV:<br>684 660<br><br>SRB STG:<br>2:03 2.02<br><br>PERF: NOMINAL<br><br>2 ENG TAL:<br>2:49 2:52<br><br>NEG RETURN:<br>3:58 4.02<br><br>PTA (U/S 160):<br>5:48 5:42<br><br>SE TAL (FMI 104):<br>6:06 6:17<br><br>PTM (U/S 160):<br>6:34 6:45<br><br>SE PRESS 104:<br>7:04 7:12<br><br>MECO CMD:<br>8:29.8 8:30.1 | KSC 15 (KSC 62)<br>198:13:14:42 Z<br>9:14:42 AM EDT<br>Monday 21<br>7/17/06 (11)<br><br>DEORBIT BURN:<br>198:12:06:55 Z<br><br>XRANGE: 258 NM<br><br>ORBIT DIR: AL 34<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3273 FT<br>198:13:14:42 Z<br>VEL: 198 KGS<br>199 KEAS<br>HDOT: -1.8 FPS<br><br>TD NORM 205:<br>2662 FT<br><br>DRAG CHUTE<br>DEPLOY:<br>189 KEAS<br>198:13:14:45 Z<br><br>NLGTD: 6646 FT<br>198:13:14:53Z<br>VEL: 149 KGS<br>145 KEAS<br>HDOT: -5.8 FPS<br><br>BRK INIT: 100 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>198:13:15:18 Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 5.6 PK 6.7<br><br>WHEELSTOP:<br>198:13:15:56 Z<br>12238 FT<br><br>ROLLOUT:<br>8965 FT<br>74 SEC | 104/104/109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/67<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/67<br>104.5<br><br>1 = 2045 (8)<br>2 = 2051 (5)<br>3 = 2056 (4)<br><br>All Block II<br>Engines<br><br>M 3 EOM:<br>WEIGHT:<br>226063 LBS<br>X CG:<br>1084.58<br><br>LANDING:<br>WEIGHT:<br>225972 LBS<br>X CG:<br>1086.32 | BI-126<br><br>RSRM<br>93<br><br>ET-119<br><br>SLWT<br>23<br><br>ET<br>IMPACT<br><br>MET<br>1:14:32<br><br>LAT:<br>35.845S<br><br>LONG:<br>157.76 W | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>123.6 NM<br>BY<br>85.0 NM<br><br>DEORBIT:<br>HA 190.7 NM<br>HP 176.7 NM<br><br>ENTRY<br>VELOCITY:<br>25862 FPS<br><br>ENTRY<br>RANGE:<br>4494 NM | OI-30<br>(2)<br><br>CARGO:<br>37736 LBS<br><br>PAYLOAD:<br>CHARGEABLE:<br>29280 LBS<br><br>DEPLOYED:<br>23696 LBS<br><br>NON-DEPLOYED:<br>5426 LBS<br><br>MIDDECK:<br>158 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br><br>DEPLOYED:<br>1239831 LBS<br><br>NON-DEPLOYED:<br>1568532 LBS<br><br>CARGO TOTAL:<br>3623596 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 3519<br>FUEL BIAS: 825<br>FINAL TDDP: 2290<br>RECON: N/A<br>(sensor fail)<br><br>PAYLOADS:<br>PLB:<br>ISS ULF1.1<br>ICC<br>MPLM<br>LMC<br>RMS, ODS, OBSS<br><br>MIDDECK:<br>ISS ULF1.1,<br>RAMBO, MAUI<br><br>5 CRYO TK SETS<br>6 GN2 TANKS<br>RMS 72 USED FOR<br>OBSS/LDRI<br>ACTIVITIES | <b>Brief Mission Summary:</b> STS-121/ULF1.1 (18 <sup>th</sup> ISS mission) continued the testing of new equipment and procedures for increasing Space Shuttle safety of flight. Specifically, this mission continued the testing of ET design and process changes for minimizing potentially damaging debris during launch, ground and flight camera systems for vehicle observations during launch, and techniques for on-orbit inspection and repair of vehicle TPS. The flight also delivered critical supplies and cargo for the repair and future expansion of the ISS.<br><br>KSC W/D: OPF 264, VAB 7, PAD 41 = 312 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline OV-103 launch date of 11/15/04 on 10/26/03<br>- Postponed launch date to NET 5/5/05 on 3/26/04. Slip due to Columbia accident<br>- Postponed launch date to NET 7/10/05 on 10/29/04. Slip due to Columbia accident<br>- Postponed launch date to NET 7/12/05 on 2/17/05 to provide on acceptable launch lighting conditions<br>- Postponed launch date to NET 9/9/05 on 5/23/05 to reflect latest planning decisions<br>- Postponed launch date to TBD on 11/15/05<br>- Postponed launch date to 5/10/06 on 3/16/06<br>- Postponed launch date to 7/1/06<br><br>LAUNCH SCRUBS:<br>- Scrubbed Saturday 7/1/2006 launch attempt at 182:19:46Z (at L-0h2m41s) while holding count at L-9 min. The window opened at 182:19:43:41 and closed at 19:53:41Z. The Preferred Launch Time was 183:19:26:11Z. Last forecast for KSC RTLS was forecast and observed NO-GO for thunderstorm attached anvils within 20 NM. KSC AOA1 and NOR AOA2 were forecast and observed NO-GO for thunderstorms within 20 NM. KSC PLS3 was forecast GO but observed crosswind of 19 knots. Primary TAL Moron and alternates Zaragoza and Istres (France) were forecast and observed GO. Weather scrub for KSC RTLS, AOA1 and PLS3.<br>- Scrubbed Sunday 7/2/2006 launch attempt at 183:17:14Z (at L-2h12m). The window opened at 183:19:21:09Z and closed at 183:19:31:09Z. The preferred launch time was 183:19:26:09Z. At the time of the scrub, there remained 7m41s to window closure. KSC RTLS was forecast NO-GO thunderstorm anvils within 20 NM and chance of broken 3000 ft and observed thunderstorms within 20 NM. KSC AOA1 was forecast NO-GO for thunderstorm anvils within 30 NM and chance of broken 3000 ft and observed thunderstorms. NOR AOA2 was forecast NO-GO for chance of thunderstorms within 30 NM and observed GO Primary TAL site Moron and alternate Istres (FMI) were forecast and observed GO. Zaragoza was forecast slight chance of thunderstorms within 20 NM but observed GO. All three TAL sites were observed GO. Weather Scrub - KSC RTLS, AOA. Management made the decision to go for a 48-hour turnaround so the fuel cell cryos could be topped off for a possible 1-day extension, power permitting. KSC RTLS/AOA/Launch weather scrub.<br><br>Continued... |     |   |  |
|   |   |  |  |  |  |  |   |   |     |   |  |
|    |   |  |  |  |  |  |   |   |     |   |  |
|   |   |  |  |  |  |  |   |   |     |   |  |
|    |   |  |  |  |  |  |   |   |     |   |  |
| ISS013-E-48774 --- Discovery approaches ISS for docking with Leonardo Multipurpose Logistics Module (MPLM) in the payload bay.                            |   |  |  |  |  |  |   |   |     |   |  |



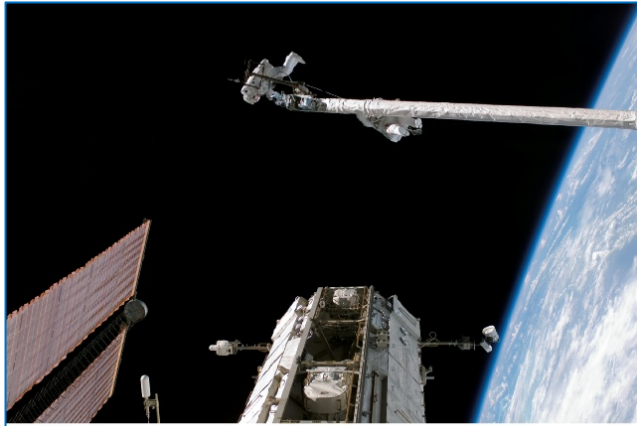


ISS013-E-48774 --- Discovery approaches ISS for docking with Leonardo Multipurpose Logistics Module (MPLM) in the payload bay.






# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-164- STS-121/ULF1.1

| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N.  | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|---|---|---|---|------------------------|------------------------|--|-----|---|--|
| STS-121/<br>ULF1.1<br><br>Continued...   |         | Continued...<br><br>MCC WHITE FCR (45)<br><br><u>FLIGHT DIRECTORS:</u><br>A/E - Steve Stich<br>LD/O 1 - Anthony Ceccacci<br>O 2 - Norman Knight<br>PLNG - Paul Dye<br>MOD - Phil Engelauf<br>ISS:<br>LD/O 2 - R.E. LaBrode<br>O 1 - A.P. Hasbrook<br>O 3/PLNG - P. F. Dye<br><br>ADO<br>EVA's | Continued...<br><br>VI:<br>25819 25821<br><br>HaHp:<br>123.6 x 31.1<br><br>OMS-2:<br>38:00 38:00<br>98.1 FPS 98.6 FPS | Continued...<br><br>WINDS: 21008 P10<br>AVE: 5H, 7R<br>PEAK: 6H, 8R<br><br><u>DENS ALT:</u><br>1691 FT<br><br><u>FLT DURATION:</u><br>12:18:36:47<br><br><u>OV-103:</u><br>263:14:49:45<br><br><u>S/T:</u><br>1058:04:03:42<br><br><u>DISTANCE:</u><br>5,293,923 sm |   |                        |                        |  |     | Continued...<br><br><u>LAUNCH WINDOW:</u><br>- The July 4th launch window opened at 185:18:32:55Z and closed at 185:18:42:56Z giving a total window of 10 minutes plus 1 second. The Preferred Launch Time (In-Plane Time) was 185:18:37:55Z.<br>- Performance close time was 185:18:41:38Z, giving a launch window of 3m43s.<br><br><u>LAUNCH DELAYS:</u><br>- None. Launch occurred on time at 185:18:37:55Z (2:37:55 PM EDT) on Tuesday, July 4, 2006. SLF crosswinds were forecast at 16 knots but STA evaluation raised RTLS crosswind limit to 17 knots. All three TAL sites were forecast GO but Zaragoza was observed NO-GO for showers within 25 NM.<br><br><u>TAL WEATHER:</u><br>- MRN (Primary TAL), Istres, and Zaragoza were all three forecast GO. Zaragoza was observed NO-GO for showers within 25 nm.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard Set plus (1) PE Low Q SUM/JUL, (2) OMS Assist, (3) 52 NM MECO, (4) Del Psi<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>- Total flight extension is 1 day.<br>- On FD4, MMT made decision to extend flight 1 day (from 12+1+2 to 13+2) to permit additional EVA to accomplish RCC/tile repair materials DTO's. The plan was to land at one of the two EOM opportunities at KSC: (1) Deorbit 202 with landing on orbit 2023 (2) Deorbit 203 with landing on orbit 204. EDW was not called up. If unable to land at KSC on EOM, EDW would be called up for a "pick 'em?" KSC or EDW. TD 6-hr weather forecast for Deorbit 202 chance of showers within 30 nm. The weather forecast update at 1155Z removed showers within 30 nm and detached anvils were removed from the forecast changing the forecast to GO for deorbit. (Deorbit 203 forecast showers within 30 nm)<br>- Deorbit burn was at 198:12:06:55Z with KSC runway 33 as the preferred runway. At EI-15, an unexpected rain shower moved toward the SLF that was expected close to HAC for runway 33 by touchdown. Re-designated from runway 33 to runway 15 at M15 (185,000 feet) to avoid the weather buildup south of the SLF. MLG touchdown was at 198:13:14:42Z (9:14:42 AM EDT) on Monday July 17, 2006 for a flight duration of 12:18:36:47. NLG touchdown was at 198:13:14:53Z. There were no further flight duration changes. Total 1 day extension for operations.<br><br><u>EIGHTH SHUTTLE CREWMEMBER REPLACEMENT</u><br>- Carlos Noriega (medical issue) was replaced by Sellers in July 2004. (6th & 7th Shuttle crewmembers replacements occurred on STS-113.)<br><br><u>RENDEZVOUS # 63:</u> Rendezvous and dock with ISS<br><br>Continued... |  |
|   |         |   |   |   |   |                        |                        |  |     |   |  |
| S121-E-06239 --- STS-121 (green shirts) & Exp 13 crews in ISS Destiny Lab. From left (front row): Reiter/FE13 (ESA), Exp 13 CDR Pavel V. Vinogradov/RSA, & Jeffrey N. Williams/FE13. From the left (middle row): Wilson/MS, CDR Lindsey, & Nowak/MS. From the left (back row): Sellers/MS. Fossum/MS. & PLT Kellv. |         |   |   |   |   |                        |                        |  |     |   |  |
|  |         |   |   |   |    |                        |                        |  |     |   |  |
|  |         |   |   |   | STS-E-06058 (8 July 2006) --- Fossum and Sellers test the Shuttle RMS and the OBSS as a platform for making repairs to a damaged orbiter. |                        |                        |  |     |   |  |



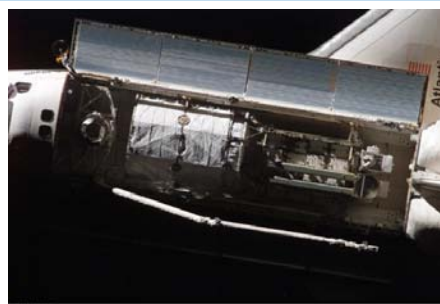
# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                        | ORBITER  | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG, THROTTLE PROFILE, ENG. S.N. | SRB RSRM, AND ET | ORBIT, INC, HA/HP | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--------------------------------|--|---|---|--|--|------------------|-------------------|-----|--|---|
| STS-121/ULF1.1<br>Continued... |   | S121-E-06199 (10 July 2006) --- Fossum and Sellers (partially out of frame) restored ISS Mobile Transporter rail car to full operation and delivered a spare cooling system pump. |   |  |  |                  |                   |     |  | Continued...<br><br><b>FIRSTS/LASTS/NEW:</b> <ul style="list-style-type: none"><li>- First flight of an ET without the Protuberance Air Load ramps as a safety improvement to reduce potential for debris.</li><li>- First test of 50-ft robotic arm boom extension as a work platform.</li><li>- First flight with hardened tiles on NLG doors.</li><li>- First use of SRMS/OBSS/Laser Dynamic Range Imager (LDRI) to scan Orbiter WLE and Nose Cap (RCC).</li><li>- DTO 848 RCC crack repair tasks using caulk guns to dispense the NOAX (non-oxide adhesive experimental) material.</li><li>- First flight of Orbiter MLG with four new larger, smoother tires that can withstand higher loads at landing.</li><li>- New procedures developed to ensure gap fillers between heat-shielding tiles stay in place (5000 replaced prior to launch).</li><li>- First flight to take GPS to NAV (BFS). Incorporated after processing TACAN approx. 140K. Performed well.</li><li>- ISS has three crew members for first time since May 2003.</li></ul> <b>EVENTS:</b> <ul style="list-style-type: none"><li>- ET Separation at 185:18:46Z, 000:00:08:51 MET.</li><li>- OMS-2 ignition at 185:19:15:55Z, 98.7 fps, resultant orbit 124.4 by 85.1 nm.</li><li>- TI ignition 187:12:04:46Z, 16.8 seconds, resulting orbit 190.1 by 177.9 nm.</li><li>- SRMS/OBSS/Laser Dynamic Range Imager (LDRI) scanned both WLE and nose cap, no anomalous conditions identified.</li><li>- ISS captured at 187:14:51:45Z (1:20:13:49 MET).</li><li>- Hard dock at 187:15:10:28Z (1:20:32:33 MET).</li><li>- ISS Hatch Open at 187:16:29Z (1:21:51 MET). Welcomed by Expedition 13 two-person crew (Vinogradov and Williams).</li><li>- IELK Seat Liner transfer at 187:19:13Z (002:00:35:05 MET which is Reiter's Shuttle time). This is the official transfer of Thomas Reiter from Space Shuttle STS-121 crew to ISS Expedition 13 crew. ISS crew increased to three persons for first time since May 2003.</li><li>- Leonardo MPLM grappled and installed on Unity Module.</li><li>- EVA 1 Start at approximately 3/18:38 MET (189:13:15:55Z) July 8. Duration 7h 31m. Blade blocker inserted into Zenith IUA of MS, OBSS/SRMS Characterization. Rerouted TUS cable. EVA from ISS Quest A/L.</li><li>- EVA 2 Start at approximately 5/17:36 met (191:12:13:55Z) July 10. Duration 6h 47m. Nadir IUA R&amp;R, Pump Module (w/FGB) transferred from ICC to ESP-2, R&amp;R TUS. Piers' SAFER became detached, Mike re-locked it.</li><li>- EVA 3 start 193:11:20:30Z (7:16:42:35 MET), July 12. Duration 7h 11m. Completed 5 samples of NOAX DTO &amp; IR imaging. Grapple Bar transferred to ISS.</li><li>- STS-121 crew farewell to ISS crew (Commander Pavel Vinogradov, Flight Engineers Jeffrey Williams &amp; Thomas Reiter).</li><li>- APAS Hatch Close at 10/13:36 MET, ODS Hatch close 10/13:38 MET (196:08:15:55Z).</li><li>- STS-121 Undock from ISS at 10/15:29 MET, 196:10:06:55Z.</li><li>- Total consumables transferred from Orbiter to ISS: Water 1545.8 lbm (1454.9 lbm in 15 CWC's and 90.9 lbm in 4 PWR's); N2 74.2 lbm transferred to Joint Air Lock tanks. No oxygen transferred between tanks.</li><li>- Cargo transferred from Orbiter to ISS total 10903.35 lbs (7423.99 from MPLM, 1862.93 from Middeck, 1616.43 from ICC).</li><li>- Cargo transferred from ISS to Orbiter total 6450.92 lbs (4389.14 plus unplanned 241.52 lbs to MPLM and 1820.26 lbs to Middeck).</li><li>- No communications blackout during entry.</li></ul> |
|                                |  | JSC2006-E-27890 --- Orbit-1 Flight Control Team group portrait in the Shuttle White Flight Control Room of JSC MCC. Flight Director Tony Ceccacci holds the STS-121 mission logo. |   |  |  |                  |                   |     |  | <b>SIGNIFICANT ANOMALIES:</b> <ul style="list-style-type: none"><li>- LSL thruster heater fail off (first launch attempt)</li><li>- ET LH2 5% fill-point sensor failed wet when commanded to dry state (during loading attempts)</li><li>- FES Full up PRI B Shutdown</li><li>- Protruding Gap Fillers</li><li>- Personal hygiene hose leak</li><li>- TPS Blanket Damage</li><li>- 85-ft safety tether #24 retraction issue</li><li>- Scratch reported on crewlock external hatch sealing surface</li><li>- SAFER 5000 (EV1) unlatched during EVA. Relocked by EV2</li><li>- APU 1 Fuel Tank Leak</li><li>- APU 3 GG/FU Pump Heaters cycling in over temp range</li><li>- Two-inch spatula inadvertently released during EVA 3</li><li>- Waste Dump Nozzle Temps A&amp;B unusual signature during condensate dump</li><li>- Right Air Data Probe initial fail to deploy</li><li>- WLEIS Inadvertent Software Shutdown (GFE)</li><li>- MCC GNC ISP Server Issue</li><li>- DOLILU PLOAD Procedural error (PLOAD LOX estimate high)</li></ul>  |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-166 - STS-115/12A

| FLT NO.   | ORBITER   | CREW (6)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET   | ORBIT  |   | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|--|---|---|---|---|--|---|---|--|---|
| STS-115/ISS 12A<br><br>SEQ FLT# 116<br><br>KSC 116<br><br>PAD 39B-52<br><br>MLP-2<br><br>19TH SHUTTLE FLIGHT TO ISS | OV-104 (Flight 27) Atlantis<br><br>OMS PODS: LPO4-RPO FRC4-27 | CDR: Brent W. Jett (Flt 4 - STS-72, STS-81, STS-97) P711/R206/V132/M179<br><br>PLT: Christopher J. Ferguson P712/R300/M261<br><br>MS1/EV1: Joseph R. Tanner (Flt 4 - STS-66, STS-82, STS-97) P713/R185/V136/M162<br><br>MS2/EV2: Daniel C. Burbank (Flt 2 - STS-106) P714/R258/V183/M225<br><br>MS3/EV3: Heidimarie M. Stefanyshyn-Piper P715/R301/F40<br><br>MS4/EV4: Steven G. MacLean (Flt 2 - STS-52) P716/R156/V184/M138 (CSA-Canada) | KSC 39B 252:15:14:55 Z 11:14:55 AM EDT (P) 11:14:55 AM EDT (A) Saturday 5 9/9/06 (11)<br><br>LAUNCH WINDOW: 4M41S (PLT in-plane)<br><br>EOM PLS: KSC TAL: MRN TAL WX: ZZA, FMI<br><br>SELECTED: RTLS: KSC 33/N/N TAL: MRN 20/N/N AOA: KSC 33/N/N PLS: EDW 22/N/N<br><br>TDEL: 0.10 .062<br><br>MAX Q NAV: 731.36 723.09<br><br>SRB STG: 2:05 2.08<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN): 2:42 2:47<br><br>NEG RETURN: 3:52 4.00<br><br>PTA (U/S 155): 5:16 5:26<br><br>SE TAL (FMI 104): 6:09<br><br>PTM (U/S 575): 6:19 6:24<br><br>SE PRESS 104: 7:00 7:00<br><br>MECO CMD: 8:23.7 8:24.8 | KSC 33 (KSC 63) 264:10:21:23 Z 6:21:23 AM EDT Thursday 10 9/21/06 (11)<br><br>DEORBIT BURN: 264:09:14:23 Z<br><br>XRANGE: 225 NM<br><br>ORBIT DIR: AL 35<br><br>AIM PT: NOMINAL<br><br>MLGTD: 3131 FT 264:10:21:23 Z<br><br>VEL: 191 KGS 189 KEAS HDOT: -1.5 FPS<br><br>TD NORM 195: 2639 FT<br><br>DRAG CHUTE DEPLOY: 181 KEAS 264:10:21:26 Z<br><br>NLGTD: 5775 FT 264:13:21:32Z<br><br>VEL: 158 KGS 156 KEAS HDOT: -6.4 FPS<br><br>BRK INIT: 107 KGS<br><br>DRAG CHUTE JETTISON: 63 KGS 264:10:21:53 Z<br><br>BRK DECEL FPS <sup>2</sup> : AVE 5.8 PK 8.5<br><br>WHEELSTOP: 264:10:22:15 Z 10670 FT<br><br>ROLLOUT: 7539 FT 52 SEC | 104/104/109%<br><br>PREDICTED: 100/104.5/ 104.5/72 104.5<br><br>ACTUAL: 100/104.5/ 104.5/72 104.5<br><br>1 = 2044 (9)<br>2 = 2048 (6)<br>3 = 2047 (9)<br><br>All 3 Block II Engines<br><br>M 3 EOM: WEIGHT: 199711 LBS X CG: 1084.99<br><br>LANDING: WEIGHT: 199642 LBS X CG: 1086.98 | BI-127<br><br>RSRM 94<br><br>ET-118<br><br>SLWT 24<br><br>ET IMPACT<br><br>MET 1:13:36<br><br>LAT: 37.58S<br><br>LONG: 160.16 W | 51.60 (19)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 154.0 NM X 123.8 NM<br><br>DEORBIT: HA 190 NM HP 179 NM<br><br>ENTRY VELOCITY: 25867 FPS<br><br>ENTRY RANGE: 4378 NM | OI-30 (3)<br><br>CARGO: 41848 LBS<br><br>PAYLOAD CHARGEABLE: 35758 LBS<br><br>DEPLOYED: 35552 LBS<br><br>NON-DEPLOYED: 0 LBS<br><br>MIDDECK: 206 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS:<br><br>DEPLOYED: 1275483 LBS<br><br>NON-DEPLOYED: 1568738 LBS<br><br>CARGO TOTAL: 3665444 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 2886 FUEL BIAS: 921 FINAL TDDP: 1749 RECON: 349<br><br>PAYLOADS: PLB: ISS 12A (P3/P4) Segment<br><br>MIDDECK: RAMBO, MAUI, RMS, ODS, OBSS<br><br>5 CRYO TK SETS 5 N2 TANKS RMS 73<br><br>RMS USED FOR OBSS/LDRI SURVEYS AND UNBERTH P3/P4 | <b>Brief Mission Summary:</b> STS-115/12A (19 <sup>th</sup> ISS mission), for the first time since late 2002, resumed assembly of the ISS. Atlantis left ISS with a new, second pair of 240-foot solar wings attached to a new 17.5-ton truss segment P3/P4 with batteries, electronics, and a giant rotating joint for sun tracking. The new solar arrays would double the ISS on-board power when the electrical systems were brought online during the STS-116 mission to follow.<br><br>KSC W/D: OPF 264, VAB 7. PAD 41 = 312 days total.<br><br>LAUNCH POSTPONEMENTS:<br>- Baseline OV-104 launch date of 4/10/03 on 3/7/02<br>- Postponed launch date to 5/23/03 on 10/8/02; delays due to engine crack repairs<br>- Postponed launch date to NET 8/21/03 on 3/13/03<br>- Postponed launch date to NET 10/30/03 on 4/17/03<br>- Postponed launch date to NET 1/22/04 on 5/28/03<br>- Postponed launch date to NET 7/24/04 on 7/29/03<br>- Postponed launch date to NET 2/10/05 on 10/3/03<br>- Postponed launch date to NET 8/28/05 on 3/22/04<br>- Postponed launch date to NET 12/8/05 on 10/29/04<br>- Postponed launch date to NET 2/16/06 on 5/23/04<br>- Postponed launch date to NET 7/1/06 on 10/31/05<br>- Changed launch date to TBD on 11/15/05<br>- Changed launch date to NET 8/28/06 on 3/16/06<br>- Advanced launch to 8/27/06 on 8/3/06 (actual launch date was 9/9/06)<br><br>LAUNCH SCRUBS:<br>- Scrubbed Sunday, 8/27/06 launch scheduled for 4:30 PM EDT at approximately L-26 hours to allow all Shuttle elements time to evaluate the lightning strike on Pad 39B on 8/26. Technical scrub. Launch rescheduled to NET 8/28/06 at 4:04 PM EDT. The Saturday, 10:00 PM EDT MMT decision was to spend another day analyzing the probability of damage to the SRB pics. The launch countdown was to continue for a NET Tuesday 8/29 launch.<br>- Scrubbed Tuesday, 8/29/06 launch at approximately L-37 hours based on a KSC forecast of 50 knots, gusts to 65 with a potential of reaching the Pad maximum of 70 knots due to Tropical Storm Ernesto. Decision made at 3:45 AM EDT on 8/29/06 morning to roll back to the VAB with option to stop and reverse the rollback if the forecast improved. Rollback to VAB started at 10:04 AM EDT. The 11 AM forecast was in fact improved. KSC would sustain winds of less than 45 knots with gusts to 60 knots that is within the pad limit of 70 knots mph. The STS-115 stack was midway between Pad B and the VAB at 2:45 PM EDT when the decision was made to stop the Rollback and return the stack to Pad B. The launch date is under assessment. Weather Scrub. Rescheduled launch to 11:29 AM EDT on 9/6/06. |  |   |
| Continued...  |   |  |   |   |   |   |  |   |   |  |   |






ISS013-E-79714 --Atlantis, carrying a crew of six, approached the orbital outpost with major elements for continuing construction of ISS.

Continued...



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|--|---------|--|---|--|--|--------------------------|-----------------------|--|-----|--|--|--|
| STS-115/<br>ISS 12A<br><br>Continued...  |         | Continued...<br>MCC WHITE FCR (46)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>A/E - J. S. Stich<br>LD/O 1 - P. F. Dye<br>O 2 - C. A. Koerner<br>O 3/PLNG - B. C. Lunney<br>MOD -<br>ISS:<br>LD/O 2 - J. A. McCullough<br>O 1 - K. B. Beck<br>O 3/PLNG - K. L. Alibaruho | Continued...<br><br>VI:<br>25819      25818<br><br>OMS-2:<br>37:21      37:20.7<br>222 FPS    220.7 FPS | Continued...<br><br><u>WINDS:</u> 2H, 3R<br><br><u>OFFICIAL:</u> 2H, 3R<br>0303P04<br><br><u>DENS ALT:</u><br>696 FT<br><br><u>FLT DURATION:</u><br>11:19:06:28<br><br><u>S/I:</u> 1069:23:10:10<br><br><u>OV-104:</u><br>231:16:32:28<br><br><u>DISTANCE:</u><br>4,910,268 sm | <br>ISS013E81630   |                          |                       |  |     | Continued...<br><br><u>LAUNCH SCRUBS:</u> (continued)<br>- Scrubbed Wednesday, 9/6/06 launch at approximately L-8.5 hours due to a fuel cell 1 coolant pump phase A short. (Pump operated on two phases.) 24-hour scrub turnaround with MMT at 1 PM 9/6 to decide launch date. The MMT decision was to press for a launch attempt on Friday, 9/8. Plan was to keep Phase A cb open during ascent. Technical scrub.<br>- Scrubbed Friday, 9/8/06 launch attempt at 251:14:53Z while holding at T-9 minutes when ET LH2 ECO Sensor #3 indicated failed wet when actually sensor was dry. 24-hour scrub turnaround. ECO sensor operated normally during drainback and on Saturday launch day. GO for launch. Technical scrub.<br><br><u>LAUNCH WINDOW:</u><br>- The 9/9/06 launch window opened at 252:15:10:39Z and closed at 252:15:19:36Z for a total launch window of 9 minutes 0 seconds. The Preferred Launch Time (In-Plane time) was 252:15:14:55Z giving a launch window of 4m41s.<br><br><u>LAUNCH DELAYS:</u><br>- None. Launch occurred on time at 252:15:14:55Z (11:14:55 AM EDT) on Saturday, September 9, 2006.<br><br><u>TAL WEATHER:</u><br>- Zaragoza and Moron were forecast NO-GO for thunderstorms within 20. FMI was forecast with a 1-knot tailwind violation (average tailwind forecast to be 11 knots and peak tailwind forecast to be 16 knots). Zaragoza was observed NO-GO for thunderstorms and attached anvil. MRN and FMI were both observed GO at TAL landing time. Moron was selected as Prime TAL site.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Standard set plus (1) PE Operational High Q SUM/AUG, (2) OMS Assist, (3) 52 NM MECO, (4) Del Psi, (5) Non-standard consumables reduction.<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>- EOM landing was planned for 263:13:04Z on 9/20/06 at KSC. However, during INCO survey of the orbiter after FCS checkout, an unidentified piece of debris was observed in Camera A. Tuesday 9/19/06 MMT decided to investigate the significance of the debris. The MMT extended the flight 1 day to allow time to perform RMS and OBSS surveys. The RMS and OBSS surveys of the PLB, both WLE and flight control surfaces using the RMS elbow camera, did not identify the debris. Atlantis was cleared for landing on EOM +1 day. Deorbit burn occurred at 264:09:14:23Z (11/17:59:28 MET) Orbit 185. Main Landing Gear touchdown on KSC Runway 33 was at 264:10:21:23Z (6:21:23 AM EDT) on Thursday, 9/20/06 for a flight duration of 11/19:06:28. Nose Landing Gear touchdown was at 264:10:21:32Z. Landing winds were forecast 03003P05 and observed 0303P04 (2H, 3R). Total flight duration extensions of 1 day (technical extension). |  |  |
| <br>S115-E-05623 (12 Sept. 2006) --- Piper, releases the restraints on the forward Solar Array Blanket Box (SABB) during EVA with Tanner, partially visible at top edge of frame. |         |  |   |  | <br>JSC2006-E-40208 --- Mike Suffredini, ISS Program Manager, responds to a question from media during STS-115 mission update briefing on Sept. 14, 2006, at JSC. Shuttle Flight Director John McCullough is at left. |                          |                       |  |     | Continued...   |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-168 - STS-115/12A

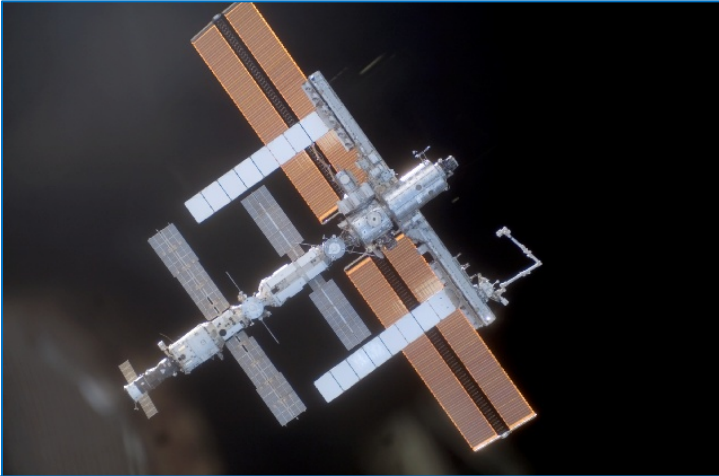


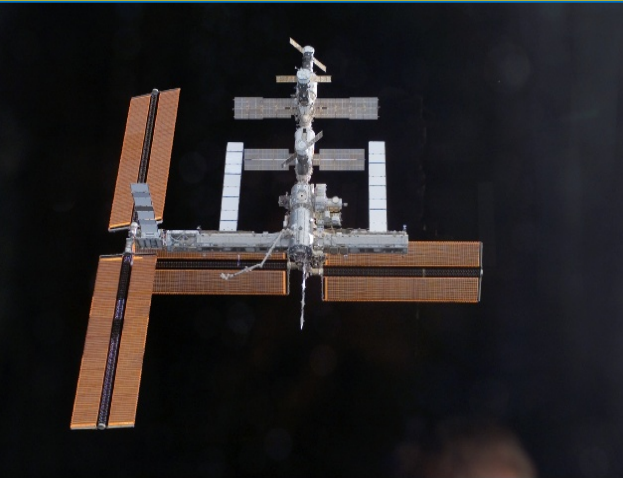
| FLT NO.                                 | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------|----------------------------------|--|--|--|--------------------|--------------------|--|-----|--|--|
| STS-115/<br>ISS 12A<br><br>Continued... |         |                                  |  |  |  |                    |                    |  |     |  | <p>Continued...</p> <p><b>RENDEZVOUS # 64:</b> Rendezvous and dock with ISS</p> <p><b>SPACE SHUTTLE NIGHT LANDING:</b> 21 (landed on runway KSC 33)</p> <p><b>FIRSTS/LASTS/NEW:</b></p> <ul style="list-style-type: none"> <li>- Used Airlock Campout Prebreathe Protocol for the first time. Crew spent sleep period isolated in the JAL (Quest Airlock) at reduced pressure of 10.2 psia.</li> </ul> <p><b>EVENTS:</b></p> <ul style="list-style-type: none"> <li>- Max Q at 252:15:15:45Z (00m50s)</li> <li>- OMS Assist ignition was 252:15:17:08Z with burn duration of 2m52s</li> <li>- OMS-2 ignition was at 252:15:52:16Z (37:21 MET), burn duration 2m25s</li> <li>- TI at 254:08:08:08Z</li> <li>- SRMS/OBSS/LDRI survey of noscap, port, and starboard wing RCC on FD2</li> <li>- ISS Docking capture at 254:10:48:27Z, 1:19:33:32 MET</li> <li>- Docking complete at 254:11:01:01Z, 1:19:46:06 MET</li> <li>- ISS Hatch Open at 1d21h19m; ISS crew welcoming</li> <li>- EVA 1 Crew began campout in ISS Airlock at 10.2 psia in prep for EVA 1.</li> <li>- EVA 1 Start at 255:09:19Z (3/18:01 MET) on 9/12/06, conducted from the ISS JAL (Quest Airlock). The astronauts used a new prebreathe protocol first tested during the handover of Expedition 12. EV1/Joe Tanner and EV2/Heidmarie Piper spent the night isolated in the JAL (Quest Airlock) with a reduced pressure of 10.2 psi while the ISS remains at 14.7 psi. This prebreathe protocol is called Prebreathe Campout Protocol (PBCOP). The Integrated Truss Segment (ITS) P3/P4 was attached to the Port 1 (P1) segment using the SSRMS. EVA crew connected power cables, released SABB and BGA restraints to prepare SARJ for operations. During removal of launch lock cover, a bolt/spring and a washer were accidentally released and lost. The EVA duration was 6:26.</li> <li>- EVA 2 Start at 256:09:18Z (4/17:51 MET) on 9/13/06,. EV3/Dan Burbank and EV4/Steven MacLean slept in the JAL for Spacewalk Prebreathe Campout Protocol. They completed preparations for the activation of SARJ for operations. EVA 2 duration was 7:11.</li> <li>- EVA 3 Start at _____. EV1/Tanner and EV2/Piper used PBCOP protocol. They completed P3 and P4 tasks, R&amp;R SASA on Z1 truss, and installed heat shield on Ku-band antenna group interface tube. The EVA duration was 6:42.</li> <li>- Hatch closed at 7/19:27 MET after saying goodbyes to Expedition 13 crew.</li> </ul> <p>Continued...</p> |



S115E05801




S115-E-05801 (13Sept. 2006) --- Burbank (red leg stripes) and MacLean/CSA (above & right) complete activation of SARJ.

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS                     | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT |   | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|--------------------------------------|---|--|--|-----------------|-------|---|-----|--|---|
| STS-115/ ISS 12A   |         |                                      |   |  |  |                 |       |   |     |  |   |
| Continued...   |         |                                      |   |  |  |                 |       |   |     |  |   |
|   |         |                                      |   |      |  |                 |       | <div>Continued...</div> <div>EVENTS: (continued)</div> <ul style="list-style-type: none"><li>- Atlantis undocking completed at 260:12:49:50Z, 7/19:27 MET</li><li>- Total cargo transferred from Atlantis to the ISS was 36678 lbs (included 35552 lbs for P4/P5, but excluding water)</li><li>- Total cargo transferred from ISS to Atlantis was 993 lbs</li><li>- Total consumables transferred from Atlantis to ISS was 1110.5 lbm of water (11 CWC's with 1043.8 lbm and four PWR's with 66.1 lbm). Total oxygen transferred to ISS was 103 lbm.</li></ul> <div>SIGNIFICANT ANOMALIES:</div> <ul style="list-style-type: none"><li>- Fuel Cell 1 Coolant Pump AC1 Phase A short caused launch scrub. (See Launch Scrubs.)</li><li>- ARD response to erroneous telemetry (ARD NO-GO)</li><li>- Elevon Positioning Procedure callout errors</li><li>- ASA 3 Speedbrake driver channel # erratic</li><li>- Starboard PLBD aft (B) closed indication ON should be OFF</li><li>- F4D Tyvek cover late release</li><li>- TPS tile and blanket anomalies (cleared for Entry)</li><li>- FES shutdown during Ascent</li><li>- Water supply dump line heater A abnormal temperature cycling</li><li>- Hydraulic System 3 TVC Pitch Actuator indication</li><li>- Water supply dump valve leak</li><li>- Sequential Stills Video failure</li><li>- APU 2 X-axis accelerometer data erratic</li><li>- S-band lower right antenna communication problems</li><li>- FES topping left duct sensor erratic/OSL</li><li>- MADIS BITE indication on FDM 2 MUX D</li><li>- Nosecap expansion seal RCC damage</li><li>- Engine 2 LO2 inlet pressure transducer reading low</li><li>- R4R heater failed on</li><li>- Aft sample bottles L1 and R2 leaking</li><li>- Starboard radiator MMOD strike</li></ul> |     |  |   |
| S115-E-05493 (11 Sept. 2006) --- ISS Configuration prior to docking of STS-115.  |         |                                      |   | JSC2006-E-40599 --- Flight Director Bryan Lunney monitors data at his console in MOCR. |  |                 |       |   |     |  |   |
|    |         |                                      |   |     |  |                 |       |   |     |  |   |
| JSC2006-E-40475 --- STS-115/12A ISS Orbit 2 flight control team portrait in the MCC. Flight Director John McCullough (center right) holds the STS-115 mission logo and CAPCOM Pamela A. Melroy holds the STS-115/12A mission logo. |         |                                      |   | S115-E-06741 (17 Sept. 2006) --- ISS Configuration <u>after</u> undocking of STS-115   |  |                 |       |   |     |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER                           | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG, THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET  | ORBIT INC HA/HP   | FSW       | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|-----------------------------------|--|--|---|--|--|---|-----------|---|---|
| STS-116/ ISS 12A.1   | OV-103 (Flight 33) DISCOVERY      | CDR: Mark L. Polansky (Flt 2 - STS-98) P717/R262/V185/M228<br>PLT: William A. Oefelein P718/R302/M262<br>MS1: Nicholas J. M. Patrick (Flt 2 - STS-105) P719/R303/V186/M263<br>MS2/EV1: Robert L. Curbeam, Jr. (Flt 3 - STS-85, STS-98) P720/R225/V167/M195<br>MS3/EV2: Christer Fuglesang (ESA) P721/R304/M264<br>MS4: Joan E. Higginbotham P722/R305/F41<br>MS5 Up/EV3/EXP14: Sunita L. Williams P723/R306/F42<br>MS5 Down/EXP14: Thomas Reiter (M/SS Up on STS-121) P724/R299/M260 | KSC 39B 344:01:47:35Z 8:47:35 PM EST (P) 8:47:35 PM EST (A) Saturday (6) 12/09/06 (8)<br>LAUNCH WINDOW: 5 Minutes (PLT in-plane)<br>EOM PLS: KSC TAL: ZZA TAL WX: MRN, FMI<br>SELECTED: RTLS: KSC 33 N/N TAL: MRN 20 N/N AOA: NOR 17 N/N PLS: EDW 22 CI<br>TDEL: 0:00 0.232<br>MAX Q NAV: 760 764<br>SRB STG: 2:04.16 2:04.64<br>PERF: NOMINAL<br>2 ENG TAL (MRN): 2:31 2:28<br>NEG RETURN: 3:55 3:52<br>PTA (U/S 160): 4:55 4:56<br>SE TAL (FMI): 6:07 6:03<br>PTM (U/S 160): 6:07 6:02<br>SE PRESS 104: 6:54 6:56<br>MECO CMD: 8:22.5 8:23.8<br>VI: 25819.0 25819.0<br>OMS-2: 37:07.4 37:10 187.2 FPS188.5 FPS | KSC 15 (KSC 64) 356:22:31:58Z 5:31:58 PM EST<br>Friday 14 12/22/06(15)<br>DEORBIT BURN: 356.21:30:53Z<br>XRANGE: 813 NM<br>ORBIT DIR: AR 13<br>AIM PT: CLOSE IN<br>MLGTD: 1825 FT 356:22:31:58Z VEL: 196 KGS 208 KEAS HDOT: -2.9 FPS<br>TD NORM 205: 2015 FT<br>DRAG CHUTE DEPLOY: 191 KEAS 356:22:32:04Z<br>NLGTD: 5594 FT 356:22:32:11Z VEL: 140 KGS 152 KEAS HDOT: -7.0 FPS<br>BRK INIT: 79 KGS<br>DRAG CHUTE JETTISON: 52 KGS 356:22:32:36Z<br>BRK DECEL FPS <sup>2</sup> : AVE 5.3 PK 6.1<br>WHEELSTOP: 356:22:32:51Z 9980 FT<br>ROLLOUT: 8155 FT 53 SEC | 104/104/109%<br>PREDICTED: 100/104.5/ 104.5/72 104.5<br>ACTUAL: 100/104.5/ 104.5/74 104.5<br>1 = 2050 (5)<br>2 = 2054 (6)<br>3 = 2058 (1)<br>ALL 3 SSME'S BLOCK II<br>M 3 EOM: WEIGHT: 226476 LBS X CG: 1077.4 in<br>LANDING: WEIGHT: 224041 LBS X CG: 1079.6 in | BI-128 RSRM 95<br>ET-123 SLWT 25<br>ET IMPACT MET 1:14:00 LAT: 36.83S LONG: 159.1W | 51.60 DIRECT INSERTION (20)<br>POST OMS-2: 134.7x122.7NM<br>DEORBIT: HA 184.5 NM HP 168.1 NM<br>ENTRY VELOCITY: 25837 FPS<br>ENTRY RANGE: 4263 NM | OF-30 (4) | CARGO: 35690 LBS<br>PAYLOAD CHARGEABLE: 22502 LBS<br>DEPLOYED: 5748 LBS<br>NON-DEPLOYED: 16572 LBS<br>MIDDECK: 182 LBS<br>SHUTTLE ACCUMULATED WEIGHTS:<br>DEPLOYED: 1281231 LBS<br>NON-DEPLOYED: 1585492 LBS<br>CARGO TOTAL: 3701134 LBS<br>PERFORMANCE MARGINS (LBS): FPR: 2886 FUEL BIAS: 921 FINAL TDDP: 3768 RECON: 4559<br>PAYLOADS: PLB: ISS 12A.1 - ITS SPACEHAB SM ICC (W/STP-H2 UTILIZATION PAYLOAD)<br>MIDDECK: ISS 12A.1 RAMBO MAUA! | <b>BRIEF MISSION SUMMARY: STS-116/12A.1 (20th ISS mission) continued ISS construction with the delivery and installation of Integrated Truss Segment P5 and began the process of reconfiguration and redistribution of the power generated by the pair of U.S. solar arrays. P6 truss was relocated to its final assembly position after 6 years atop the Unity Module.</b><br><br>KSC W/D: OPF 105, VAB 8, PAD 28 = 141 days total<br><br>LAUNCH POSTPONEMENTS:<br>- Baselined OV-104 launch date of 06/05/2003 on 05/05/2002<br>- Postponed launch date to 07/24/2003 on 10/08/2002; delays due to engine flowliner crack repairs<br>- Postponed launch date to NET 12/18/2003 on 03/13/2003. Slip due to Columbia accident.<br>- Postponed launch date to NET 03/01/2004 on 04/17/2003. Slip due to Columbia accident.<br>- Postponed launch date to NET 05/13/2004 on 05/28/2003. Slip due to Columbia accident.<br>- Postponed launch date to NET 09/13/2004 on 07/29/2003. Slip due to Columbia accident.<br>- Postponed launch date to NET 04/14/2005 on 10/03/2003. Slip due to Columbia accident.<br>- Delete flight from FDRD on 03/22/2004<br>- Re-baselined STS-116 launch date to NET 02/09/2006 on 12/09/2004<br>- Postponed launch date to NET 04/23/2006 on 05/23/2005. Slip reflected latest planning decisions.<br>- Postponed launch date to NET 10/01/2006 on 10/31/2005. Slip reflected latest planning decisions.<br>- Postponed launch date to NET 11/16/2006 on 03/16/2006. Slip reflected latest planning decisions.<br>- Postponed launch date to NET 12/14/2006 on 04/04/2006. Slip reflected latest planning decisions.<br>- Advanced launch date to NET 12/07/2006 on 09/28/2006.<br><br>LAUNCH SCRUBS:<br>- Scrubbed Thursday 12/7/06 EST launch (12/8/06 GMT day 242) while holding at T-5 minutes. The window opened at 342:02:30:48Z and closed at 342:02:40:48Z with a Preferred Launch Time of 342:02:35:48Z. TAL1 (ZZA) was forecast and observed GO at TAL landing time and was selected as Prime TAL site. TAL2 (MRN) was forecast NO-GO thunderstorms WI 20 NM and BKN30 and observed NO-GO BKN. TAL3 (FMI) was forecast and observed NO-GO BKN30/BKN35. Launch Director counted down and held at 5 minutes until window closed. Scrubbed launch due to Range Safety violation of clouds below 6000 feet, thicker than 500 feet (verified at 5500 feet). MMT opted for a 48-hour turnaround and top off cryos and weather forecast was NO-GO. Launch date set for 12/09/06 EST (12/10/06 GMT). Weather Scrub.. |
| SEQ FLT# 117   | OMS PODS: LPO1-36 RPO3-34 FRC3-33 |  |  |   |  |  |   |           |   |   |
| KSC-117  |                                   |  |  |   |  |  |   |           |   |   |
| PAD 39B-53   |                                   |  |  |   |  |  |   |           |   |   |
| MLP-1  |                                   |  |  |   |  |  |   |           |   |   |
| 20TH SHUTTLE FLIGHT TO ISS   |                                   |  |  |   |  |  |   |           |   |   |
|    |                                   |  |  |   |  |  |   |           |   |   |
|   |                                   |  |  |   |  |  |   |           |   |   |
|  |                                   |  |  |   |  |  |   |           |   |   |
| Continued...   |                                   |  |  |   |  |  |   |           |   |   |





S116-E-05504 --- View from Discovery AFD of payload bay and approaching ISS (background) . Shown in PLB are shuttle's docking mechanism (foreground), Spacehab (partially obscured), Canadian-built RMS robotic arm (right), and RMS/Orbiter Boom Sensor System (left, in stowed position).

Continued...

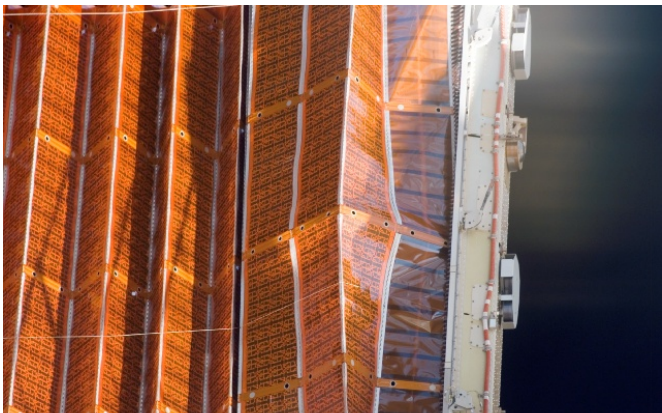


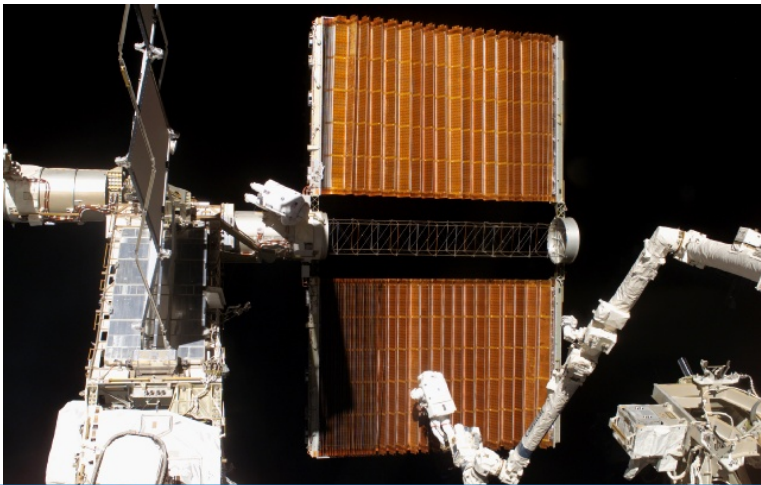
Continued...

# SPACE SHUTTLE MISSIONS SUMMARY


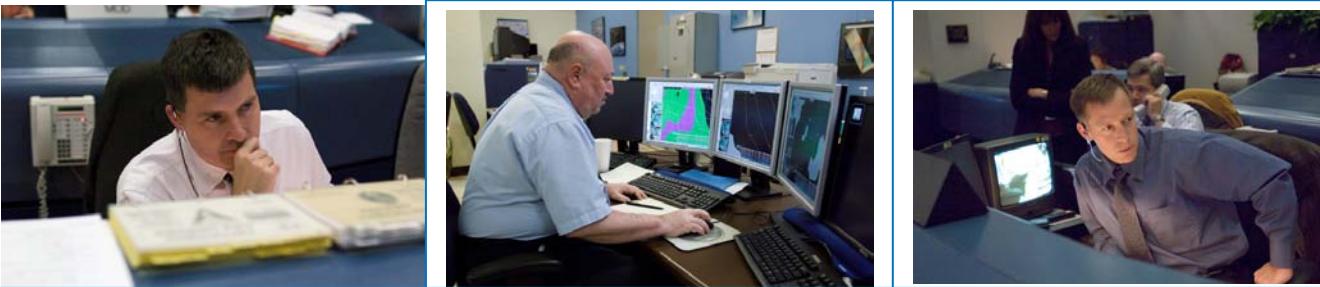
| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET | ORBIT |  | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|---|---|---|--|-----------------|-------|--|---|---|---|
| STS-116/ISS 12A.1<br>Continued...  |         | Continued...<br>MCC WHITE FCR (47)<br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>A - J. S. Stlich<br>E - N. D. Knight<br>LD/O 1 - A. J. Ceccacci<br>O 2 - M. R. Abbott<br>O 3/PLNG - R. E. LaBrose<br>Team 4 - R. S. Jones<br>MOD - P. L. Engelauf<br>ISS:<br>LD/O 2 - J. M. Curry<br>O 1 - J. D. Hassmann<br>O 3 - J. R. Montalbano<br>TEAM 4/PLNG - D. J. Weigel<br><br><u>CAPCOMS:</u><br><u>SHUTTLE:</u><br>A/E - K. T. Ham<br>- C. J. Ferguson (Wx)<br>LD/O1 - K. A. Ford<br>O2 - K. M. McArthur<br>O3/PLNG - S. W. Lucid<br>Team 4 PLNG - N/A<br>ISS:<br>LD/O2 - S. K. Robinson<br>O1 - T. W. Virts<br>O3/PLNG - H. D. Getzelman<br>Team 4 PLNG - N/A |   | Continued...<br><br>WINDS: 14H/2R Kts<br>OFFICIAL: 159/14<br>14/2R Kts<br><br>DENS ALT:<br>1229 FT<br><br>FLT DURATION:<br>12:20:44:23<br><br>S/T: 1082:19:54:33<br><br>OV-103:<br>276:11:34:05<br><br>DISTANCE:<br>5,330,398 sm<br><br>TOTAL SHUTTLE DISTANCE:<br>438,715,036 sm | S116-E-06472 --- STS-116 & Exp 14 crews gather in ISS Destiny Lab. From the left (front row): Reiter/Exp 14FE/MS-Dn, Patrick/MS, Higginbotham/MS, & PLT Oefelein. From the left (center row): Curbeam/MS, Fuglesang/MS (ESA), & CDR Polansky. From the left (back row): CDR Exp14 Lopez-Alegria, Mikhail Tyurin/Exp14/FE (RSA), & Williams/MS-Up/ Exp14FE. |                 |       |  | Continued...<br><br>5 CRYO TK SETS<br>6 N2 TANKS<br>RMS 74<br><br>RMS USED FOR RMS/OBSS SURVEYS AND GRAPPLE/ UNBERTH P5, HANDOFF TO SSRMS | Continued...<br><br><u>LAUNCH WINDOW:</u><br>- Total launch window was 10 minutes with window open at 344:01:42:35Z and close at 344:01:52:35Z. Preferred Launch Time was 344:01:47:35Z (In-Plane Time) for a launch window of 5m00s. NOTE: In October, the self-imposed post-Columbia daylight launch constraint was relaxed, thus clearing STS-116 for a night launch.<br><br><u>LAUNCH DELAYS:</u><br>- None. Launch occurred on time at 344:01:47:35Z, 8:47:35 PM EST on Saturday, 12/09/06.<br><br><u>TAL WEATHER:</u><br>- All three TAL sites were forecast and observed GO. MRN was selected as Prime TAL site. MRN had best TD energy, ZZA had low TD energy, and FMI had balloon problems.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>- Include the standard set plus: (1) PE Operational High Q WIN/DEC, (2) OMS Assist, (3) 52 nm MECO, and (4) Del Psi<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>- Early planning had STS-116 as an 11+1+2 flight that was changed a few weeks before the flight to 12+0+2 as consumables proved adequate. Pre-flight EOM TIG was 11/17:47 MET with landing at 11/18:49 MET. Difficulties with P5 retraction resulted in an FD8 MMT decision to add an unscheduled EVA 4 to inspect P5 for feasibility of retraction by EVA crew. This resulted in a loss of a weather wave-off day and a 13+1 flight. Undocking would be delayed 1 day and FD10 would be used for a late inspection.<br><br><u>NIGHT LAUNCH #29:</u><br><br><u>RENDEZVOUS #65:</u> Rendezvous and dock with ISS<br><br><u>FIRSTS/LASTS/NEW:</u><br>- First flight of Advanced Health Monitoring System (AHMS). Flew on right engine in monitor mode.<br>- First use of Quest for four EVA's and four Campout Prebreathes on a Shuttle flight<br>- First flight with four EVA's by one astronaut - Curbeam<br>- First on-orbit retraction of an ISS solar array<br>- First ISS crew rotation through Shuttle since STS-113/11A in November 2002<br>- First entry of a Shuttle on the day of landing opportunity that was both the first and "pick 'em" days of opportunity for weather |   |
| <div><div><br/>S116E05983</div><div><br/>S116E06472</div><div>LEFT: S116-e-05983 - Curbeam (left) and Fuglesang conduct EVA1 tasks for installation of P5 Truss. New Zealand and Cook Strait are seen in the background.</div></div> |         |   |   |   |  |                 |       |  |   |   |   |
| Continued...   |         |   |   |   |  |                 |       |  |   |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.            | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--------------------|---------|--------------------------------------|---|--|--|-----------------|-------|--|-----|--|--|
| STS-116/ ISS 12A.1 |         |                                      |   |  |  |                 |       |  |     |  | Continued...   |
| Continued...       |         |                                      |   |  |  |                 |       |  |     |  | <p>EVENTS:</p> <ul style="list-style-type: none"> <li>- OMS Assist ignition at 344:01:49:50Z (duration 1m38s)</li> <li>- SRMS OBSS/LDRI survey of nosecap, port and starboard wing RCC (WLE's) completed</li> <li>- T1 maneuver at 345:19:28:22Z (1:17:40:47 MET). Resultant altitude 176.7 by 192.4 nm</li> <li>- R-Bar pitch maneuver started at 345:21:04:46Z and was completed 7m33s later. Photos of Discovery's tile surfaces by ISS crew</li> <li>- Docking capture occurred at 345:22:11:05Z (1:20:23:30 MET).</li> <li>- Hard dock occurred at 345:22:26:33Z (1:20:38:58 MET).</li> <li>- ISS hatch open 345:23:54Z (1:22:06 MET), ISS Crew Welcoming</li> <li>- IELK seat liner transfer at 346:01:00:00Z (1:23:12 MET). At that time, Thomas Reiter became a member (MS5) of STS-116 and Sunita Williams joined the ISS Expedition 14 as Flight Engineer 2.</li> <li>- EVA 1: EV1 and EV2 completed nominal tasks including P5 truss installed to P4 truss and mated P4-P4 umbilicals. 5/8-in socket lost from Pistol Grip Tool. EVA 1 duration 6h36m</li> <li>- FD5: P6 4B SAW retraction required a series of partial deploy/retract sessions into 19 bays out for P4 SARJ to be free to rotate. P6 4B SAW now 16.5 bays out</li> <li>- Solar flares raised radiation level. Crew slept in areas with better shielding.</li> <li>- EVA 2: EV1 and EV2 Ch 2/3 reconfig and transfer to permanent power. CETA cart relocate. EVA 2 duration 5h00m</li> <li>- FD7: Several IVA tests "wiggling" SAW, then extension/retraction were unsuccessful, 17.5 bays out</li> <li>- EVA 3: EV1 and EV3 Ch 1/4 reconfig and transfer to permanent power. T/S P6 SAW. In an attempt to free the wires and grommets, oscillations and retractions were attempted. An additional 6 bays retracted, leaving additional 11 bays out. During EVA, a digital camera floated away. EVA 3 duration 7h31m.</li> <li>- FD8: ISS and Space Shuttle Programs reached a joint decision to extend STS-116/12A.1 to 13+1 days to perform an unscheduled EVA to troubleshoot and complete P6 SAW retraction. Undocking now on FD11</li> <li>- EVA 4: Curbeam and Fuglesang, unscheduled EVA 4 start at 352:19:00:00Z (8:17:12:25 MET). EVA crew successfully retracted P6 the last 36 feet by repeated actions of pulling on guide wires, shaking, and retract commands. Array was successfully retracted and folded into box. EVA duration 6h38m</li> <li>- Total cargo transferred to ISS from Discovery was 4877 lbs (middeck 1305 lbs and logistics single module 3572 lbs).</li> </ul> <p>Continued...</p> |
|                    |         |                                      |   |  |  |                 |       |  |     |  |  <p>S116-E-05789 - A kink occurred in the port-side P6 solar array during the first attempt to retract that array on Dec. 13, 2006.</p>   |
|                    |         |                                      |   |  |  |                 |       |  |     |  |  <p>JSC2006-E-54706 ---FD Matt Abbott talks to Paul Hill, Mgr Space Shuttle Mission Ops in FCR during the final deployment of some small satellites.</p>   |
|                    |         |                                      |   |  |  |                 |       |  |     |  |  <p>JSC2006-E-53934 (12 Dec. 2006) --- John Shannon, Deputy Shuttle Program Manager and Manager, MMT, emphasizes a point during a MMT meeting in JSC MCC. Behind Shannon are Wayne Hale (left), Shuttle Program Manager; and Robert D. Cabana, JSC Deputy Director.</p>   |
|                    |         |                                      |   |  |  |                 |       |  |     |  |  <p>S116-E-06854 - FD10: EVA 4 Curbeam &amp; Fuglesang (out of frame), working in tandem, used specially-prepared tape insulated tools to guide the P6 overhead SAW neatly inside its blanket box.</p>  |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.               | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|-----------------------|---------|----------------------------------|--|--|--|--------------------|--------------------|--|-----|--|--|
| STS-116/<br>ISS 12A.1 |         |                                  |  |  |  |                    |                    |  |     |  | <p>Continued...</p> <p><b>EVENTS (Continued):</b></p> <ul style="list-style-type: none"> <li>- Total cargo transferred to Discovery from ISS was 4911 lbs (to middeck 1345 lbs and to logistics module 3566 lbs).</li> <li>- Total consumables transferred to ISS: Oxygen tank transfer 69 lbm and total nitrogen tank transfer 47.2 lbm; total water transferred to ISS was 261.6 lbm (201.9 lbm in two CWC's and 59.7 lbm in three PWR's).</li> <li>- Undocked at 353:22:09:35Z</li> <li>- A flyaround (1/2 lap) was initiated at 353:22:35:13Z.</li> <li>- Sep 1 and Sep 2 maneuvers resulted in orbit 171.1 by 192.5 nm</li> <li>- Micrometeoroid Orbital Debris late inspection was completed.</li> <li>- MEPSI payload was deployed at 355:00:19:35Z (10:22:32:00 MET).</li> <li>- RAFT payload was deployed at 355:01:56:46Z (11:00:09:11 MET).</li> <li>- ANDE was deployed at 355:18:23Z (11:16:35 MET).</li> <li>- No communications blackout during Entry.</li> </ul> <p><b>SIGNIFICANT ANOMALIES:</b></p> <p>Orbiter:</p> <ul style="list-style-type: none"> <li>- Loss of RMS End Effector Auto Release Capability</li> <li>- Fuel Cell O<sub>2</sub> Flowmeter Failed</li> <li>- FES Primary B Failed To Come Out Of Standby</li> <li>- Port Mid Payload Bay Floodlight Failed</li> <li>- A6U Aft Event Thumbwheel Failure</li> <li>- TPS Tile And Blanket Anomalies</li> <li>- ML94B Bogen Bracket Shoe Debonded</li> <li>- Kodak DCS 760 Digital Camera Lost During EVA 3</li> <li>- Waste Water Dump Degraded Flow</li> <li>- Z Star Tracker Pressure BITE Fail Indication</li> <li>- GPS Receiver Failed To Change Satellites</li> <li>- MADS Signal Dropout</li> <li>- WLE IDS Sensor Unit Inadvertent Shutdown</li> </ul> <p>SRB:</p> <ul style="list-style-type: none"> <li>- SRB Separation Debris Impact On Orbiter Not A Safety Issue</li> <li>- T-0 Umbilical 1/4-Inch Frangible Bolt Missing</li> <li>- Delaminated/Missing BTA on Aft BSM Housing</li> </ul> <p>RSRM: No IFA's</p> <p>SSME: No IFA's</p> <p>ET: No IFA's</p> <p>MOD:</p> <ul style="list-style-type: none"> <li>- Erroneous Procedure Callout on OBSS LCS Cue Card</li> <li>- MCC Automation System (MAS) File Server Failure</li> </ul> <p>Integration:</p> <ul style="list-style-type: none"> <li>- Ice Balls Noted Hanging From The North GOX Vent Arm Duct Exit Flange</li> <li>- Debris Release from SRB LH BSM Area Traveled Fwd And Impacted Orbiter</li> <li>- Delaminated/missing BTA on Aft BSM Housing with Sooting</li> </ul> |
| Continued...          |         |                                  |  <p>S116E07113 - ISS Configuration, FD11 view from departing Shuttle.</p>  |  |  |                    |                    |  |     |  |  |
|                       |         |                                  |  <p>----- IN THE JSC CONTROL CENTER -----</p> <p>LEFT: JSC2006-E-53281 --- Steve Stich, STS-116 Ascent Flight Director, monitors data and video at his console.</p> <p>CENTER: JSC2006-E-53261 --- Karl A. Silverman with the Space Flight Meteorology Group pores through weather data.</p> <p>RIGHT: JSC2006-E-53290 --- CAPCOM Christopher J. Ferguson follows the latest data (in background Stephen N. Frick).</p> |  |  |                    |                    |  |     |  |  |



## Page 2-174 - STS-117/13A4

[illegible]

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                         | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG | SRB RSRM AND ET | ORBIT INC HA/HP | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---------------------------------|---------|---|--|--|-------------------------|-----------------|-----------------|-----|--|---|
| STS-117/ISS 13A<br>Continued... |         | <p>Continued...</p> <p>SS EVA 105<br/>DOCKED QUEST EVA 28<br/>EMU/TETHERED EVA 98<br/>SCHEDULED EVA 97<br/>DURATION 6:29</p> <p>MCC WHITE FCR (48)</p> <p><u>FLIGHT DIRECTORS:</u><br/><u>SHUTTLE:</u><br/>A/E - N. D. Knight<br/>LD/O1 - C. A. Koerner<br/>O2 - B. C. Lunney<br/>O3/PLNG - R. S. Jones<br/>MOD - P. L. Engelauf<br/>Team 4 - M. L. Sarafin</p> <p>ISS:<br/>LD/O2 - K. B. Beck<br/>O1 - A. P. Hasbrook<br/>O3/PLNG - H. E. Ridings<br/>Team 4 - S. P. Davis</p> <p><u>CAPCOMS:</u><br/><u>SHUTTLE:</u><br/>A/E - D. A. Antonelli<br/>- T. W. Virts (Wx)<br/>LD/O1 - T. W. Virts<br/>O2 - K. A. Ford<br/>O3/Plng - R. S. Kimbrough<br/>Team 4 - N/A</p> <p>ISS:<br/>LD/O2 - K. M. McArthur<br/>O1 - S. G. Bowen<br/>O3/PLNG - R. M. Davis<br/>Team 4 - N/A</p> | <p>Continued...</p> <p>VI:<br/>25819.0 25818.5</p> <p>OMS-2:<br/>37:46 38:30<br/>98.7 FPS 96.8 FPS</p> | <p>Continued...</p> <p>WINDS:<br/>1.9T/0.5R KTS<br/>OFFICIAL:<br/>08002P06 KTS<br/>5T/3L KTS</p> <p><u>DENS ALT:</u><br/>5169 FT</p> <p><u>FLT DURATION:</u><br/>13:20:11:33</p> <p><u>S/I:</u> 1096:16:06:06</p> <p><u>OV-104:</u><br/>245:12:44:01</p> <p><u>DISTANCE:</u><br/>5,809,363 sm</p> <p><u>TOTAL SHUTTLE DISTANCE:</u><br/>444,524,399 sm</p> |                         |                 |                 |     |  | <p>Continued...</p> <p><u>TAL WEATHER:</u> Launch Day Synopsis: "Showers and thunderstorms will develop during the daylight hours on Friday across Spain and France but are expected to diminish rapidly after sunset. TAL landing times are well after sunset." ZZA and FMI TAL Sites were forecast and observed GO. ZZA was selected as Prime TAL Site. MRN was not available.</p> <p><u>PERFORMANCE ENHANCEMENTS:</u><br/>- Include the standard set plus: (1) PE Operational High Q SUM/JUN, (2) OMS Assist, (3) 52 nm MECO, Del Psi, and (4) Non-standard Consumables Reduction.</p> <p><u>FLIGHT DURATION CHANGES/LANDING:</u><br/>STS-117 was planned as an 11+2+2 duration flight.<br/>- FD4: The MMT concurred with the recommendation to repair the Port OMS Pod thermal blanket damage incurred during ascent. An additional 2 days, docked to the ISS, and a 4th EVA were added to conduct the repair.<br/>- FD14: Two KSC landing attempts (12:55 pm &amp; 2:30 pm CDT) were waved due to weather. After wave-off, an Orbit Adjust Maneuver was added to the timeline. This 11 FPS burn brought in an additional landing opportunity (total of 3) for Edwards AFB on Friday, FD15.<br/>- FD15: KSC landing attempt at 1:18 pm CDT was waved due to weather. Landing site was switched to Edwards AFB for a successful landing on Orbit Rev 219 at 2:49 pm CDT (12:49 pm PDT). (PAO: "It's a good day to land in California...")</p> <p><u>FIRSTS/LASTS:</u><br/>- First flight of 2007.<br/>- First Launch from PAD 39A since final flight of Columbia.<br/>- First flight of Advanced Health Monitoring System (AHMS) on all three Sesame's. One flew in Active Mode. Two flew in Monitor Mode. In active mode, AHMS provides safe engine shutdown for excessive turbopump vibrations.<br/>- Sunita Williams sets new female long duration spaceflight record of 195 Days 18 Hours 58 Min, breaking Shinned Lucid's record of 188 Days 4 Hours. Williams surpassed Lucid's record on Saturday, 06/16/07, at 12:47 a.m. CDT<br/>- First EVA repair of Shuttle thermal blanket.<br/>- Last flight for James Reilly. Reilly flew to two space stations and clocked more than 853 hours in space, with five space walks totaling over 31 hours. He left NASA in June 2008.</p> <p><u>RENDEZVOUS #66:</u> Rendezvous and dock with ISS</p> <p><u>EVENTS:</u><br/>- OMS 2 ignition at 160:00:16:34Z resulted in a 123.7 by 84.7 nm orbit.<br/>- SRMS OBSS/LDRI survey of noscap, port and starboard wing RCC (WLE's) was completed. At 160:03:50Z, the crew reported damage to a thermal blanket on the Port OMS POD.</p> <p>Continued...</p> |



S117-E-07686 (16 June 2007) --- STS-117 & Exp 15 crewmembers portrait in Destiny Lab. From the left (front row): Anderson/FE Exp 15, Williams/MS/STS-117, Exp 15 CDR Yurchikhin (Russia), & Kotov/FE Exp 15 (Russia). From the left (middle row): PLT Archambault/STS-117 and STS-117 CDR Sturckow. From the left (back row) Forrester, Reilly, Swanson and Olivas, all MS/STS-117.



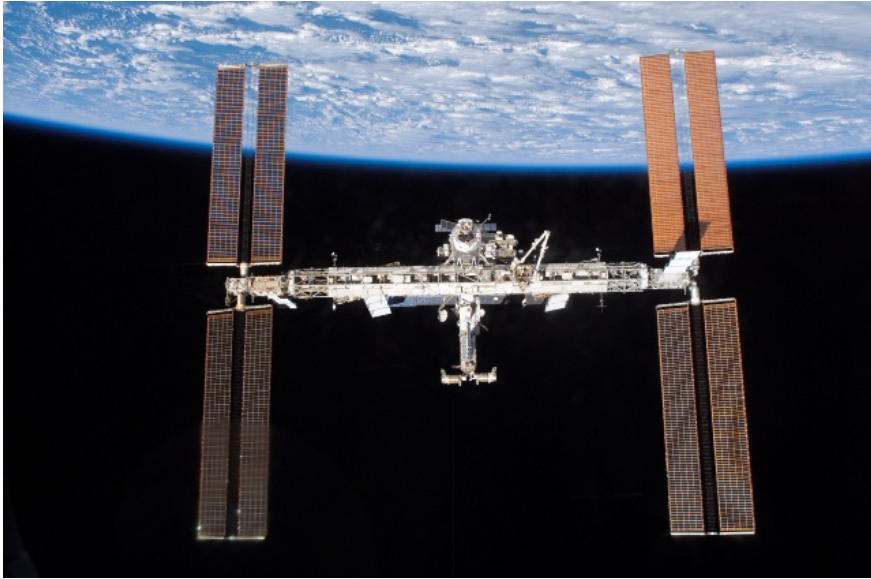
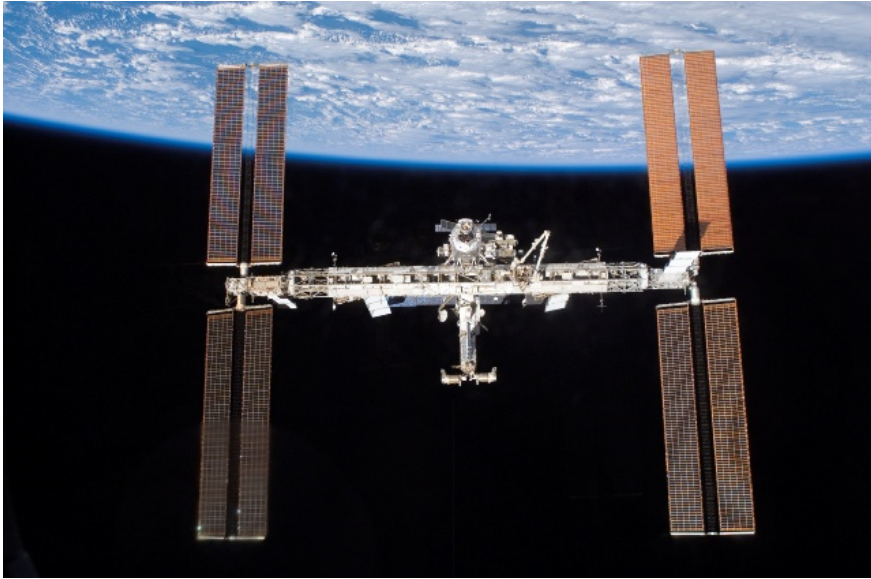
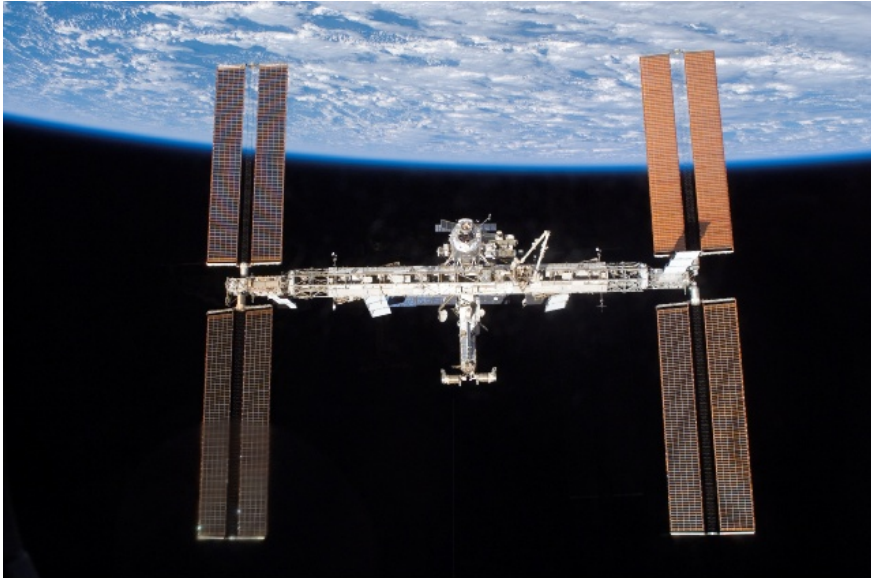
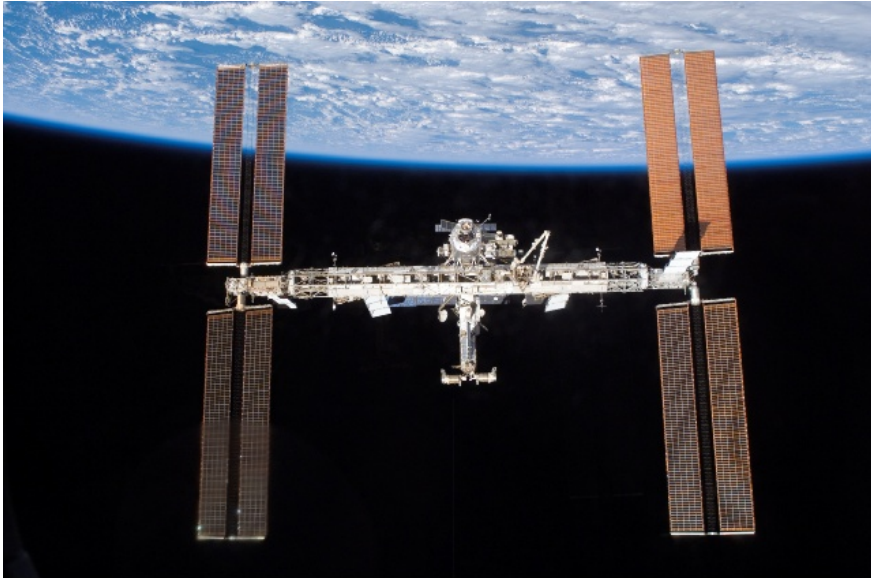
S117E07686



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---------|----------------------------------|---|--|--|--------------------|--------------------|--|-----|--|---|
| STS-117/<br>ISS 13A<br>Continued...   |         |                                  |   |  |  |                    |                    |  |     |  | Continued...  |
|  <p>iss015e12948 -- EVA Repair: Anchored to a foot restraint on the RMS robotic arm, astronaut John "Danny" Olivas moves toward port OMS pod thermal blanket damage during EVA 3. Skin stapler and pins were used to make the repair.</p>       |         |                                  |   |  |  |                    |                    |  |     |  |   |
|  <p>S117-E-07789 Forrester/EV3 (left) Swanson/EV4, participate in 4th EVA as construction continues on ISS. Among other tasks, Forrester and Swanson continued activation of the station's new starboard 3 and 4 (S3/S4) truss segments.</p> |         |                                  |   |  |  |                    |                    |  |     |  |   |
| <p>S117-E-06886 --- Reilly/EV1(center) Olivas/EV2 (right) connect power, data &amp; cooling cables to S1 &amp; S3, and deploy solar array blanket boxes on S4.</p>  |         |                                  |   |  |  |                    |                    |  |     |  |   |
|   |         |                                  |   |  |  |                    |                    |  |     |  | <p>Continued...</p> <p><b>EVENTS</b> (continued):</p> <ul style="list-style-type: none"> <li>- T1 maneuver at 161:17:00:57Z: Resultant orbit was 181.2 by 179.4 nm orbit</li> <li>- Rbar Pitch Maneuver was performed. Photos of Atlantis' tile surfaces and the damaged OMS POD thermal blanket were taken by ISS crew. The thermal blanket damage was later determined to be from ET foam/ice shedding from LO2 line bracket during ascent.</li> <li>- Docking Capture occurred at 161:19:36:10Z</li> <li>- Hard Docking occurred at 161:19:47:48Z.</li> <li>- ISS Hatch open 161:21:20:00Z, 4:20 pm CDT, Sunday, June 10, 2007, ISS crew welcoming</li> <li>- IELK Seat Liner transfer at 162:00:55Z (7:55 PM CDT, June 10, 2007). At that time, Sunita Williams became a member of STS-120 and Daniel Tani joined the ISS Expedition 16 as Flight Engineer.</li> <li>- STS-117 delivered new set of solar arrays on 21st flight to ISS; P6 Starboard array was retracted for over 3 days.</li> <li>- "Suni" Williams was replaced by Clay Anderson on Expedition 15 and returned home on STS-117 with long duration space record for a female (see Firsts above).</li> <li>- FD4 - Station robotic arm used to install S3/S4 truss on S1 truss.</li> <li>- FD4 EVA 1: Reilly/EV1 &amp; Olivas/EV2 completed the following tasks for S3/S4 Power Generation work: connected 13 power &amp; data umbilicals, unstowed &amp; deployed 1A &amp; 3A solar arrays, and uncinched/unwinded photovoltaic radiator (PVR) for deployment. SARJ work included: installing 4 alpha joint I/F structure (AJIS) struts, installing drive lock assembly (later, EVA 2 determined a problem, see below), removed 6 SARJ locks, and released all swing bolts along SARJ. EVA 1 duration: 6h16m.</li> <li>- FD4 - MMT Management Decisions Summary: On 06/11/07, the MMT concurred: (1) that the Port OMS Pod TPS Blanket is considered [to be] suspect in case of a contingency deorbit, (2) with performing a repair of the OMS Pod Blanket, and (3) with adding 2 extension days and a 4th EVA.</li> <li>- FD5: Activities completed nominally. Solar Array deployment - 8 bays retracted. Array behavior similar to 4B retraction on STS-116 (sticking grommets, asymmetric folding).</li> <li>- FD6: Russian central and terminal computers failed during docked operations at GMT 164:15:15:00Z and were restored with jumper cables bypassing power monitoring devices.</li> <li>- FD6 EVA 2: Forrester/EV3 &amp; Swanson/EV4 conducted partial retraction of P6 2B Solar Array (including cut leader). Inspected P6 aft radiator starboard PIP pin (only one confirmed). SARJ work included: Installed 4 SARJ brace beams, installed DLA 1 (discovered DLA's were cross wired on the ground), removed 10 SARJ launch locks, and broke torque on 3 SARJ launch restraints. EVA 2 duration: 7h16m.</li> </ul> <p>Continued...</p> |




## SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                         | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS       | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---------------------------------|---------|--------------------------------------|---|--|--|------------------------|------------------------|--|-----|--|--|
| STS-117/ISS 13A<br>Continued... |         |                                      |   |  |  |                        |                        |  |     |  | Continued...<br><br><u>EVENTS (Continued):</u><br>- <b>FD8 EVA 3:</b> Conducted by Reilly/EV1 & Olivas/EV2: Removed Lab H2O Vent & installed Lab H2 Vent, repaired OMS POD thermal blanket with skin stapler and pins, relocated 1 of 3 APFR's for 13A.1, and finished retraction of P6 2B Solar Array. This was unscheduled EVA added by MMT. EVA 3 duration: 7h58 m.<br>- <b>FD10 EVA 4:</b> Conducted by Forrester/EV3 & Swanson/EV4: Activated SARJ for rotation, cleared S3 Mobile Transporter path, relocated 2 of 3 APFR's for 13A.1, released torque on S4 MMOD Shield bolts, moved VSSA to Camera Port 1, cleared Node 1 Port for 10A Node 2 temporary stowage, and opened Lab H2 Vent. EVA duration: 6h 29m.<br><u>Transfers:</u><br>- Mid-deck resupply cargo transfer to ISS from Atlantis was 1277 lbs.<br>- Mid-deck return cargo transfer to Atlantis from ISS was 1528 lbs.<br>- Supply Water total to ISS was 751 L (1,656 lbm)<br>- Oxygen (net) to ISS was 89 lbm<br>- Nitrogen to ISS: to A/L tanks 17.3 lbm; into stack for repress 16 lbm<br>- Lithium Hydroxide (LiOH): STS [used] to ISS = 3, ISS (new) to STS = 3<br>- Undocked at 170:14:42:00Z followed by a fly-around (1/2 lap).<br>- Sep 1 & Sep 2 maneuvers resulted in orbit of 185.0 x 177.1 nm<br>- Micrometeoroid Orbital Debris late inspection was completed.<br>- No communications blackout during Entry.<br><br><u>SIGNIFICANT ANOMALIES:</u><br><u>Orbiter:</u><br>- MDM OA2 CARD 5 Failed - Invalid Data<br>- MADS Recorder Tape Speed Went To 120 IPS (Nom is 15) at Nose Wheel TD<br>- E3 LH2 Inlet Pressure Transducer Went OSH at T+ 3.5 Min<br>SRB: None.<br>RSRM:<br>- Gas Penetration Through Nozzle Joint 2 RTV, RSRM-96A&B<br>SSME: None.<br>ET:<br>- Post-Launch Camera & Film Rev. - Loss of LH2 Acreage Foam at Stations 1160, 1623 & 1871<br>MOD:<br>- GDR Data Dropouts During Ascent<br>- Ascent LOC Push Button Inoperative<br>- LCC Activation Turning Off WLES PGSC<br>Integration:<br>- Tile Piece Liberated From Aft Fuselage Body Flap I/F During Ascent<br>- FOD Found In Aft Compartment<br>- Port OMS Pod Blanket Damage During Ascent<br>- Rope-Like Material Noted Moving In Umbilical Well Imagery<br>- Propellant Use During FDS Extended Shuttle Attitude - Hold Approx 3 Times Higher Than Predicted |
|                                 |         |                                      |   |  |  |                        |                        |  |     |  | Continued...<br><br><u>EVENTS (Continued):</u><br>- <b>FD8 EVA 3:</b> Conducted by Reilly/EV1 & Olivas/EV2: Removed Lab H2O Vent & installed Lab H2 Vent, repaired OMS POD thermal blanket with skin stapler and pins, relocated 1 of 3 APFR's for 13A.1, and finished retraction of P6 2B Solar Array. This was unscheduled EVA added by MMT. EVA 3 duration: 7h58 m.<br>- <b>FD10 EVA 4:</b> Conducted by Forrester/EV3 & Swanson/EV4: Activated SARJ for rotation, cleared S3 Mobile Transporter path, relocated 2 of 3 APFR's for 13A.1, released torque on S4 MMOD Shield bolts, moved VSSA to Camera Port 1, cleared Node 1 Port for 10A Node 2 temporary stowage, and opened Lab H2 Vent. EVA duration: 6h 29m.<br><u>Transfers:</u><br>- Mid-deck resupply cargo transfer to ISS from Atlantis was 1277 lbs.<br>- Mid-deck return cargo transfer to Atlantis from ISS was 1528 lbs.<br>- Supply Water total to ISS was 751 L (1,656 lbm)<br>- Oxygen (net) to ISS was 89 lbm<br>- Nitrogen to ISS: to A/L tanks 17.3 lbm; into stack for repress 16 lbm<br>- Lithium Hydroxide (LiOH): STS [used] to ISS = 3, ISS (new) to STS = 3<br>- Undocked at 170:14:42:00Z followed by a fly-around (1/2 lap).<br>- Sep 1 & Sep 2 maneuvers resulted in orbit of 185.0 x 177.1 nm<br>- Micrometeoroid Orbital Debris late inspection was completed.<br>- No communications blackout during Entry.<br><br><u>SIGNIFICANT ANOMALIES:</u><br><u>Orbiter:</u><br>- MDM OA2 CARD 5 Failed - Invalid Data<br>- MADS Recorder Tape Speed Went To 120 IPS (Nom is 15) at Nose Wheel TD<br>- E3 LH2 Inlet Pressure Transducer Went OSH at T+ 3.5 Min<br>SRB: None.<br>RSRM:<br>- Gas Penetration Through Nozzle Joint 2 RTV, RSRM-96A&B<br>SSME: None.<br>ET:<br>- Post-Launch Camera & Film Rev. - Loss of LH2 Acreage Foam at Stations 1160, 1623 & 1871<br>MOD:<br>- GDR Data Dropouts During Ascent<br>- Ascent LOC Push Button Inoperative<br>- LCC Activation Turning Off WLES PGSC<br>Integration:<br>- Tile Piece Liberated From Aft Fuselage Body Flap I/F During Ascent<br>- FOD Found In Aft Compartment<br>- Port OMS Pod Blanket Damage During Ascent<br>- Rope-Like Material Noted Moving In Umbilical Well Imagery<br>- Propellant Use During FDS Extended Shuttle Attitude - Hold Approx 3 Times Higher Than Predicted |
|                                 |         |                                      |   |  |  |                        |                        |  |     |  | Continued...<br><br><u>EVENTS (Continued):</u><br>- <b>FD8 EVA 3:</b> Conducted by Reilly/EV1 & Olivas/EV2: Removed Lab H2O Vent & installed Lab H2 Vent, repaired OMS POD thermal blanket with skin stapler and pins, relocated 1 of 3 APFR's for 13A.1, and finished retraction of P6 2B Solar Array. This was unscheduled EVA added by MMT. EVA 3 duration: 7h58 m.<br>- <b>FD10 EVA 4:</b> Conducted by Forrester/EV3 & Swanson/EV4: Activated SARJ for rotation, cleared S3 Mobile Transporter path, relocated 2 of 3 APFR's for 13A.1, released torque on S4 MMOD Shield bolts, moved VSSA to Camera Port 1, cleared Node 1 Port for 10A Node 2 temporary stowage, and opened Lab H2 Vent. EVA duration: 6h 29m.<br><u>Transfers:</u><br>- Mid-deck resupply cargo transfer to ISS from Atlantis was 1277 lbs.<br>- Mid-deck return cargo transfer to Atlantis from ISS was 1528 lbs.<br>- Supply Water total to ISS was 751 L (1,656 lbm)<br>- Oxygen (net) to ISS was 89 lbm<br>- Nitrogen to ISS: to A/L tanks 17.3 lbm; into stack for repress 16 lbm<br>- Lithium Hydroxide (LiOH): STS [used] to ISS = 3, ISS (new) to STS = 3<br>- Undocked at 170:14:42:00Z followed by a fly-around (1/2 lap).<br>- Sep 1 & Sep 2 maneuvers resulted in orbit of 185.0 x 177.1 nm<br>- Micrometeoroid Orbital Debris late inspection was completed.<br>- No communications blackout during Entry.<br><br><u>SIGNIFICANT ANOMALIES:</u><br><u>Orbiter:</u><br>- MDM OA2 CARD 5 Failed - Invalid Data<br>- MADS Recorder Tape Speed Went To 120 IPS (Nom is 15) at Nose Wheel TD<br>- E3 LH2 Inlet Pressure Transducer Went OSH at T+ 3.5 Min<br>SRB: None.<br>RSRM:<br>- Gas Penetration Through Nozzle Joint 2 RTV, RSRM-96A&B<br>SSME: None.<br>ET:<br>- Post-Launch Camera & Film Rev. - Loss of LH2 Acreage Foam at Stations 1160, 1623 & 1871<br>MOD:<br>- GDR Data Dropouts During Ascent<br>- Ascent LOC Push Button Inoperative<br>- LCC Activation Turning Off WLES PGSC<br>Integration:<br>- Tile Piece Liberated From Aft Fuselage Body Flap I/F During Ascent<br>- FOD Found In Aft Compartment<br>- Port OMS Pod Blanket Damage During Ascent<br>- Rope-Like Material Noted Moving In Umbilical Well Imagery<br>- Propellant Use During FDS Extended Shuttle Attitude - Hold Approx 3 Times Higher Than Predicted |
|                                 |         |                                      |   |  |  |                        |                        |  |     |  | Continued...<br><br><u>EVENTS (Continued):</u><br>- <b>FD8 EVA 3:</b> Conducted by Reilly/EV1 & Olivas/EV2: Removed Lab H2O Vent & installed Lab H2 Vent, repaired OMS POD thermal blanket with skin stapler and pins, relocated 1 of 3 APFR's for 13A.1, and finished retraction of P6 2B Solar Array. This was unscheduled EVA added by MMT. EVA 3 duration: 7h58 m.<br>- <b>FD10 EVA 4:</b> Conducted by Forrester/EV3 & Swanson/EV4: Activated SARJ for rotation, cleared S3 Mobile Transporter path, relocated 2 of 3 APFR's for 13A.1, released torque on S4 MMOD Shield bolts, moved VSSA to Camera Port 1, cleared Node 1 Port for 10A Node 2 temporary stowage, and opened Lab H2 Vent. EVA duration: 6h 29m.<br><u>Transfers:</u><br>- Mid-deck resupply cargo transfer to ISS from Atlantis was 1277 lbs.<br>- Mid-deck return cargo transfer to Atlantis from ISS was 1528 lbs.<br>- Supply Water total to ISS was 751 L (1,656 lbm)<br>- Oxygen (net) to ISS was 89 lbm<br>- Nitrogen to ISS: to A/L tanks 17.3 lbm; into stack for repress 16 lbm<br>- Lithium Hydroxide (LiOH): STS [used] to ISS = 3, ISS (new) to STS = 3<br>- Undocked at 170:14:42:00Z followed by a fly-around (1/2 lap).<br>- Sep 1 & Sep 2 maneuvers resulted in orbit of 185.0 x 177.1 nm<br>- Micrometeoroid Orbital Debris late inspection was completed.<br>- No communications blackout during Entry.<br><br><u>SIGNIFICANT ANOMALIES:</u><br><u>Orbiter:</u><br>- MDM OA2 CARD 5 Failed - Invalid Data<br>- MADS Recorder Tape Speed Went To 120 IPS (Nom is 15) at Nose Wheel TD<br>- E3 LH2 Inlet Pressure Transducer Went OSH at T+ 3.5 Min<br>SRB: None.<br>RSRM:<br>- Gas Penetration Through Nozzle Joint 2 RTV, RSRM-96A&B<br>SSME: None.<br>ET:<br>- Post-Launch Camera & Film Rev. - Loss of LH2 Acreage Foam at Stations 1160, 1623 & 1871<br>MOD:<br>   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-178 - STS-118/13A.1

| FLT NO.  | ORBITER                                    | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N.   | SRB RSRM<br><br>AND ET   | ORBIT  |  | FSW  | PAYLOAD WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|--|---|--|---|--|--|--|--|--|--|--|
| STS-118/<br>ISS 13A.1  | OV-105<br>(Flight 20)<br>ENDEAVOUR         | CDR:<br>Scott J. Kelly<br>(Flt 2 - STS-103)<br>P733/R253/V187/M220  | KSC 39A<br>220:22:36:42Z<br>6:36:42 PM EDT (P)<br>6:36:42 PM EDT (A)<br>Wednesday (14)<br>8/8/07 (8) | KSC 15 (KSC 65)<br>233:16:32:17Z<br>12:32:17 PM EDT<br>Tuesday (21)<br>08/21/07 (8)   | 104/104/109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/74/<br>104.5<br><br>1 = 2047 (10)<br>2 = 2051 (6)<br>3 = 2045 (9)<br><br>M 3 EOM:<br>WEIGHT:<br>221740 LBS<br>X CG:<br>1078.1 IN<br><br>LANDING:<br>WEIGHT:<br>221660 LBS<br>X CG:<br>1079.8 IN | BI-130<br><br>RSRM<br>97<br><br>ET-117<br>SLWT<br>27<br><br>ET<br>IMPACT<br><br>MET<br>1:14:03<br><br>LAT:<br>36.9S<br><br>LONG:<br>159.2W | 51.6<br>(22)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2:<br>172.2X124.2 NM<br><br>DEORBIT:<br>HA 187.2 NM<br>HP 22.8 NM<br><br>ENTRY<br>VELOCITY:<br>25860 FPS<br><br>ENTRY<br>RANGE:<br>4343 NM | OI-30<br>(6)<br><br>CARGO:<br>37390 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>23899 LBS<br><br>DEPLOYED:<br>11830 LBS<br><br>NON-DEPLOYED:<br>11740 LBS<br><br>MIDDECK:<br>329 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1329454 LBS<br><br>NON-DEPLOYED:<br>1597761 LBS<br><br>CARGO TOTAL:<br>3781165 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 2651<br>FUEL BIAS: 1063<br>FINAL TDDP: 1913<br>RECON: 2435<br><br>PAYLOADS:<br>PLB:<br>ISS 13A.1-ITS S5<br>SPACEHAB SM,<br>ESP-3<br><br>MIDDECK:<br>ISS 13A.1<br>RAMBO<br>MAUI<br><br>5 CRYO TK SETS<br><br>RMS 76<br>ODS, OBSS<br><br>RMS USED FOR<br>RMS/OBSS<br>SURVEYS AND<br>GRAPPLE/<br>UNBERTH S5,<br>HANDOFF TO<br>SSRMS | <b>BRIEF MISSION SUMMARY:</b> STS-118/13A (22 <sup>nd</sup> ISS mission) continued the assembly and resupply of the International Space Station and fulfilled a long-standing teacher's legacy. The new assembly included the delivery of the S5 Truss segment, installation of a spare parts platform, and changeout of a failed gyroscope. This was the last shuttle resupply mission using the SPACEHAB module. In addition, Barbara R. Morgan, who had served as backup to Christa McAuliffe in the Teacher in Space Project 21 years earlier, flew as the first Educator Mission Specialist. McAuliffe was a member of the crew that lost their lives in the 1986 Challenger accident.<br><br>KSC W/D: OPF 1332+64+63+18 = 1477, VAB 9, PAD 25 = 1511<br>Total Work Days (OPF Processing occurred over a total time period of 1665 days.)<br><br>LAUNCH POSTPONEMENTS:<br>- Added STS-118 to FDRD - launch date of 10/09/03 on 08/01/02.<br>- Postponed to NET 11/13/03 on 10/08/02 due to engine flowliner crack repairs.<br>- Postponed to NET 05/06/04 on 03/13/03 due to Columbia accident.<br>- Postponed to NET 06/01/04 on 04/17/03 due to Columbia accident.<br>- Deleted flight from FDRD on 05/28/03.<br>- Re-baselined to NET 09/14/06 on 07/14/05.<br>- Revised to "TBD" on 11/10/05. Slip reflected latest manifest constraints.<br>- Postponed to NET 06/11/07 on 04/04/06. Slip reflected latest manifest constraints.<br>- Postponed to NET 06/28/07 on 11/02/06. Slip due to ET delivery/processing schedule.<br>- Postponed to NET 08/09/07 on 04/16/07. Slip due to STS-117 rollback.<br>- Advanced to 08/07/07 on 06/28/07. Provide an adequate number of launch opportunities before a range conflict.<br>- Launch delayed to 08/08/07 on 08/03/07 due to "cabin leak checks and other processing work."<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH WINDOW:<br>- Total launch window was 8 minutes 11 seconds with window open at 220:22:32:45Z and close at 220:22:40:56Z. Preferred Launch Time was 220:22:36:42Z (In-Plane Time) for a launch window of 4m14s.<br><br>LAUNCH DELAYS:<br>- None. Launch occurred on time at 220:22:36:42Z, 6:36:42 PM EDT on Wednesday, 08/08/07.<br><br>TAL WEATHER:<br>Forecast: Pressure gradient between a surface high over northern Spain and low over northern Italy will keep NW winds at FMI and ZZA Wednesday through Friday. Peak winds at FMI are forecast to be above headwind limits all 3 days, but remain within limits at ZZA. MRN weather is forecast "GO" all 3 days.<br><br>Continued... |  |  |
| SEQ<br>FLT# 119  | OMS PODS:<br>LPO3-31<br>RPO4-27<br>FRC5-20 | PLT:<br>Charles O. Hobaugh<br>(Flt 2 - STS-104)<br>P734/R268/V188/M234  | LAUNCH WINDOW:<br>4M 14S<br>(PLT IN-PLANE)   | DEORBIT BURN:<br>233:15:25:12Z<br><br>XRANGE: 697 NM<br><br>ORBIT DIR: A/L 37<br><br>AIM PT: NOMINAL<br><br>MLGTD: 1628 FT<br>233:16:32:17Z<br>VEL: 210 KGS<br>212 KEAS<br>HDOT: -3.1 FPS<br><br>TD NORM 205:<br>2302 FT<br><br>DRAG CHUTE<br>DEPLOY:<br>163 KEAS<br>233:16:32:30Z<br><br>NLGTD: 5619 FT<br>233:16:32:29Z<br>VEL: 169 KGS<br>165 KEAS<br>HDOT: -6.3 FPS<br><br>BRK INIT: 123 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>233:16:32:59Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 6.1 PK 9.1<br><br>WHEELS STOP:<br>233:16:33:16Z<br>11862 FT<br><br>ROLLOUT:<br>10234 FT<br>46 SEC<br><br>Continued... |  |  |  |  |  |  |  |
| KSC-119  |  |   |  |   |  |  |  |  |  |  |  |
| PAD 39A-42   |  |   |  |   |  |  |  |  |  |  |  |
| MLP-1  |  |   |  |   |  |  |  |  |  |  |  |
| 22ND<br>SHUTTLE<br>FLIGHT TO<br>ISS  |  |   |  |   |  |  |  |  |  |  |  |
|    |  | MS 1/R:<br>Tracy E. Caldwell<br>P735/R311/F43<br><br>MS 2/EV1:<br>Richard A. Mastracchio<br>(Flt 2 - STS-106)<br>P736/R257/V189/M224<br><br>MS 3/EV2:<br>David R. Williams (Canada)<br>P737/R312/M269<br><br>MS 4:<br>Barbara R. Morgan<br>P738/R313/F44<br><br>MS 5:<br>B. Alvin Drew<br>P739/R314/M270  |  |   |  |  |  |  |  |  |  |
|  |  | SS EVA 106<br>DOCKED QUEST EVA 29<br>EMU/TETHERED EVA 99<br>SCHEDULED EVA 98<br>DURATION 6:17<br><br>SS EVA 107<br>DOCKED QUEST EVA 30<br>EMU/TETHERED EVA 100<br>SCHEDULED EVA 99<br>DURATION 6:28<br><br>SS EVA 108<br>DOCKED QUEST EVA 31<br>EMU/TETHERED EVA 101<br>SCHEDULED EVA 100<br>DURATION 5:28<br><br>SS EVA 109<br>DOCKED QUEST EVA 32<br>EMU/TETHERED EVA 102<br>SCHEDULED EVA 101<br>DURATION 5:02<br><br>Continued... |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  |  |
|  |  |   |  |   |  |  |  |  |  |  | </   |



ISS015-E-21711 - Endeavour delivers a new S5 stbd truss segment, cargo inside the SPACEHAB module (in center of bay), and the external stowage platform 3 to ISS.

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-179 - STS-118/13A.1


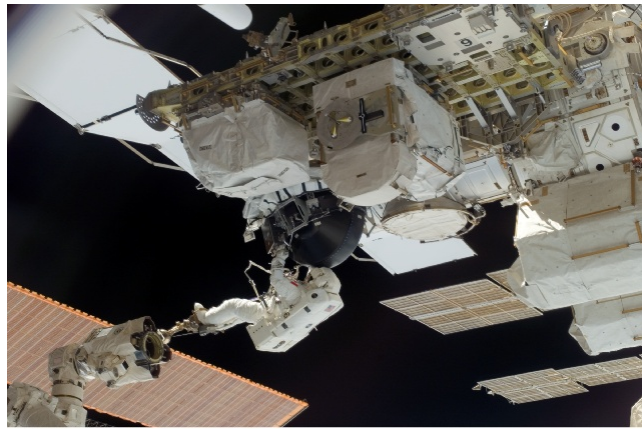
| FLT NO.   | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N.  | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP |  | FSW   | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|--|---|---|---|--------------------|--------------------|--|---|--|--|
| STS-118/<br>ISS 13A.1<br>Continued...   |         | Continued...<br><br>MCC WHITE FCR (49)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>A/E - J. S. Stich<br>LD/O1 - M. R. Abbott<br>O2 (FD1-FD6) - R. S. Jones<br>O2 (FD7-EOM) - M. L. Sarafin<br>O3/PLNG (FD1-Undock) - M. P. Moses<br>O3/PLNG/Prelaunch/Post-Undock - P. F. Dye<br>MOD - P. L. Engelauf<br>Team 4 - R. E. LaBrode<br><br>ISS:<br>LD/O2 - J. R. Montalbano<br>O1 - K. L. Alibaruho<br>O3/PLNG - G. Kerrick<br>Team 4 - J. D. Hassmann<br><br><u>CAPCOMS:</u><br><u>SHUTTLE:</u><br>A/E - C. J. Ferguson<br>- J. P. Dutton (Wx)<br>LD/O1 - S. K. Robinson<br>O2 - R. S. Kimbrough<br>O3/PLNG - S. W. Lucid<br>Team 4 - N/A<br><br>ISS:<br>LD/O2 - S. Walker<br>O1 - D. A. Antonelli<br>O3/PLNG - L. McCullough<br>Team 4 - N/A | Continued...<br><br>VI:<br>25819.0 25817.4<br><br>OMS-2:<br>37:00 37:00.7<br>253.9 FPS252.6 FPS | Continued...<br><br>WINDS:<br>6H 4L KTS<br>OFFICIAL:<br>11909P13 KTS<br>10H 8L KTS<br><br><u>DENS ALT:</u><br>1973 FT<br><br><u>FLT DURATION:</u><br>12:17:55:35<br><br><u>S/T:</u> 1109:10:01:41<br><br><u>OV-105:</u><br>219:08:07:41<br><br><u>DISTANCE:</u><br>5,274,977 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>449,799,376 sm | ISS015-E-23031 --- Exp 15 & STS-118 crews in ISS Destiny Lab: Front row, from left: Clayton C. Anderson/FE Exp15, CDR Exp15 Fyodor Yurchikhin (RSA), & Oleg Kotov/FE (RSA). STS-118 crew: middle row, from left: Drew/MS, Morgan/MS, Williams/MS (CSA), & CDR Kelly. Back row, from left: PLT Hobaugh, Mastracchio/MS, & Caldwell/MS. |                    |                    |  | Continued...<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: 1) PE Operational High Q WIN/DEC, 2) OMS Assist, 3) a 52 nm MECO, and 4) Del Psi<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>On 8/12/07, FD5, the MMT concurred with extending the Mission to 14+2 days and adding EVA 4.<br><br><u>FIRSTS/LASTS:</u><br>- First flight of Endeavour in 5 years<br>- First flight test of new system to monitor ECO circuit voltage to fuel sensors. System allows Flight Controllers to recommend manual engine shutdown by the crew if sensor voltage has failed.<br>- First flight of Automated Meteorological Profiling System (AMPS) High Resolution (HR) as primary system for DOLILU wind measurements - replacement for Jimspheres.<br>- First flight that Station Shuttle Power Transfer System (SSPTS) available to provide extended duration capability to shuttle<br>- First flight that three-string Global Positioning System (GPS) was used to replace landing TACAN System - previously flown single string only.<br>- First flight of SRB Command Receiver/Decoder (CRD). Replaced Integrated Receiver/Decoder (IRD) and Range Safety Distributor (RSD) due to obsolescence concerns<br>- Last flight of SPACEHAB resupply module.<br>- First and last flight of Educator Mission Specialist Barbara R. Morgan. She left NASA and returned to Boise State University in 2008.<br><br><u>NIGHT LAUNCH</u> - N/A<br><br><u>RENDEZVOUS #67:</u> Rendezvous and dock with ISS<br><br><u>NINTH SHUTTLE CREWMEMBER REPLACEMENT</u><br>- Clay Anderson was replaced by Drew in August 2007. (8th Shuttle crewmember replacement occurred on STS-121.)<br><br><u>EVENTS:</u><br>- OMS 2 ignition at 220:22:47:15Z resulted in a 172.2 by 124.7 nm orbit.<br>- SRMS OBSS/LDRI survey of noscap and port and starboard wing RCC (WLE's) was completed.<br>- TI maneuver at 222:15:15:19Z - resultant orbit was 186.5 by 180.4 nm<br>- During R-Bar Pitch Maneuver, a gouge in the heat shield below the right wing (site 3) was identified.<br>- Docking contact occurred at 222:18:01:54Z.<br>- Hard Dock occurred at 222:18:29:44Z. |  |  |
| <div><p>ISS015E23031</p></div> |         |  |   |   |   |                    |                    |  |   |  |  |
| Continued...  |         |  |   |   |   |                    |                    |  |   |  |  |



ISS015E23031

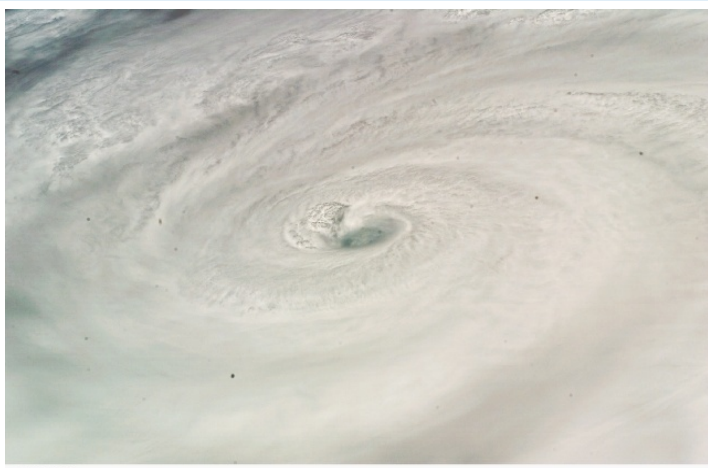






# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                            | ORBITER  | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N. | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|------------------------------------|--|--------------------------------------|---|---|---|------------------------|------------------------|--|-----|--|---|
| STS-118/ ISS 13A.1<br>Continued... |  |                                      |   |   |   |                        |                        |  |     |  | Continued...  |
|                                    | <div><div><p>S118e06114 - Barbara R. Morgan flew as first Educator Mission Specialist</p></div><div><p>S118-E-06998 - Anchored to the foot restraint on the Canadarm2, Williams, and Mastracchio (out of frame), R&amp;R a faulty control moment gyroscope (CMG-3) into the Z1 truss during EVA 2.</p></div></div> |                                      |   |   |   |                        |                        |  |     |  | <p>Continued...</p> <p><b>EVENTS (Continued):</b></p> <ul style="list-style-type: none"><li>- ISS Hatch open 222:20:04:00Z, 3:04 pm CDT, Friday, August 10, 2007, ISS crew welcoming</li><li>- FD4: MMT, per Flight Rule 13A.1_A2-6 concurred that TPS was considered to be damaged.</li><li>- FD4, EVA 1: EV1 and EV2 installed S5 on S4, relocated S5 PVRGF to S5 Keel (ground strap bolt would not seat again, like P5), retracted and cinched P6 Forward PVR, and retrieved EVA ratchet from STBD Z1 toolbox. EVA 1 duration 6h17m.</li><li>- FD5: MMT concurred that TPS was considered to be damaged and authorized focused TPS inspection. Mission was extended to 14+2 and EVA4 (preplanned) was added.</li><li>- FD6, EVA 2: EV1 and EV2 completed R&amp;R of faulty CMG 3 into ISS Z1 truss, installed old CMG3/FSE/FRAM on nadir ESP-2 FRAM Site #5 with MLI cover (no straps), and retrieved EVA ratchet from PORT Z1 toolbox. The failed CMG will remain at its temporary stowage location until it is returned to Earth on a later shuttle mission. The new gyroscope is one of four CMG's used to control Station attitude on orbit. EVA 2 duration 6h28m.</li><li>- FD8, EVA 3: EV1 and EV3 (Exp 15/16) relocated P6 SASA to P1 zenith, installed P1 S-band BSP and Xpdr, moved CETA cart 1 to STBD of MT (connected to MT), moved CETA cart 2 to STBD of MT (connected to CETA 1), and removed P6 S-band Xpdr (dummy box plate installed). EV1 EVA terminated early to EMU glove damage at EVA Phase Elapsed Time (PET) 4:20. The damage did not cause leakage; the suit pressure was unaffected. Due to the early termination, the S-band Antenna Structural Assembly (SASA) Spare Gimbal Locks and Materials International Space Station Experiment (MISSE) 3 and 4 tasks were not completed. EVA 3 duration 5h28m.</li><li>- FD8: EVA 4 delayed from FD9 to FD11 by MMT for potential tile repair.</li><li>- FD9: MMT decided that the TPS repair issue required a Programmatic assumption of risk and that the MMT was willing to assume that risk. The preponderance of data (including ground analysis and arc jet testing) indicated acceptable margins to fly as is. MMT decided that no TPS repair would be performed on Endeavour and that the nominal planned EVA 4 would be executed on FD11.</li><li>- FD11, EVA 4: EV2 and EV3 (EXP 15/16) installed OBSS OSE (2) on S1 zenith trunnions, re-torqued Z1 SASA gimbal bolts, removed MISSE 3 and MISSE 4 from A/L and returned on Shuttle, Lab EWIS antenna handrails and cable installed (Lab fwd endcone nadir - got 3 of 3 DZU's installed), and retrieved tools from A/L toolboxes. Did not perform Lab or Node MMOD shield cleanup or S3 WETA installation. EVA 4 duration 5h 2m.</li><li>- FD12: MOD contingency plans for Hurricane Dean Preparedness included decreasing the flight control support to two teams and evacuation on military aircraft if required. The plan was not required to be implemented.</li></ul> <p>Continued...</p> |

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-181 - STS-118/13A.1

| FLT NO.                           | ORBITER  | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS               | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET   | ORBIT<br>INC HA/HP |              | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|-----------------------------------|--|---|---|--|--|---|--------------------|--------------|-----|--|---|
| STS-118/ISS 13A.1<br>Continued... | RIGHT: S118-E-07918 - Category 4 Hurricane Dean, viewed from Endeavour, was moving westerly in the Caribbean nearing Jamaica with sustained winds of 150 mph. MOD contingency evacuation plans were prepared, but not needed.  |   |   |  |  |  |                    | Continued... |     |  |   |
|                                   | <u>EVENTS (Continued):</u><br>- <u>Transfers:</u><br>- Hardware transferred to ISS (outside and inside): 14,740 lbs<br>- Hardware/supplies returned from ISS: 3,297 lbs<br>- Water delivered to ISS: 918.6 lbm<br>- Oxygen to ISS: 77 lbm<br>- Nitrogen to ISS: 33.8 lbs<br>- Lithium Hydroxide (LiOH) cans from ISS to STS: 12 cans (9 old, 3 used)<br>- LiOH new cans from STS to ISS: 30 cans<br>- Power transferred from ISS to orbiter using the SSPTS was 1186 kWh.<br>- Undocked at 170:14:42:00Z followed by a flyaround (1/2 lap)<br>- Sep 1 and Sep 2 maneuvers resulted in orbit 185.2 by 183.5 nm.<br>- Micrometeoroid Orbital Debris late inspection was completed. No issues.<br>- No communications blackout during Entry.  |   |   |  |  |   |                    |              |     |  |   |
|                                   | <u>SIGNIFICANT ANOMALIES:</u><br><u>Orbiter:</u><br>- A Magenta Hue Appeared On Camera (GFE).<br>- STS-118 Drag Chute Reefing Line Cutter Failure to Cut (GFE).<br><u>SRB:</u><br>- None.<br><u>RSRM:</u><br>- Gas Penetrations through Nozzle Joint 2 RTV, RSRM-97A&B<br><u>SSME:</u><br>- 3 Com Card/Cable Failed (GFE).<br><u>ET:</u><br>- 2007 ET-117 Film Review Found TPS Loss at Sta. 1623 Outboard LO <sub>2</sub><br>- Feedline Support Bracket and TPS Orb Impact<br>- XT 1973 Inboard LO <sub>2</sub> Feedline Bracket Base Fitting TPS Crack on ET-117<br>- Post-Launch Camera and Film Review Showed Loss of LH <sub>2</sub> Acreage Foam<br><u>MOD:</u><br>- B30M Power Failure B-C Power Feeds<br>- Margi Output Error<br>- ET Umbilical Door Closure Timing<br>- SSRMS Movement Prior To Shuttle Ku Mask<br>- OBSS Sensor Mode Change From 6 to 2 per MCC<br>- Procedure Error on PGSC Setup<br><u>Integration:</u><br>- Partial Tyvek Cover Release<br>- SSRMS Movement Prior to Shuttle Ku Mask<br>- BFS Loss of Class III Alert from Spacehab E |   |   |  |  |   |                    |              |     |  |   |
|                                   |  |   |   |  |  |   |                    |              |     |  |   |
|                                   |  |    | TOP: JSC2007-E-42079 -- In MCC Lead FD Matt Abbott follows the in-space ops.<br>MIDDLE: JSC2007-E-41693 --- In MCC FD Richard Jones follows launch preps at KSC.<br>BOTTOM: JSC2007-E-42074 --- In MCC Shannon Walker ISS CAPCOM, ISS Lead FD Joel Montalbano (right), & Steven W. Lindsey (standing), Chief of Astronaut Office, keep up with in-space ops.      |  |  |   |                    |              |     |  |   |
|                                   |  |   |   |  |  |   |                    |              |     |  |   |
|                                   |  |  |   |  |  |   |                    |              |     |  |   |
|                                   |  |   | JSC2007-E-46429 (17 Sept. 2007) --- The STS-118 Ascent/Entry flight control team and crewmembers pose for a group portrait in the space shuttle flight control. Flight director Steve Stich holds mission logo with CDR Kelly (left), & CAPCOM Chris Ferguson (right). Additional crewmembers pictured are PLT Hobaugh, Morgan/MS, Caldwell/MS, & Mastracchio/MS. |  |  |   |                    |              |     |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY



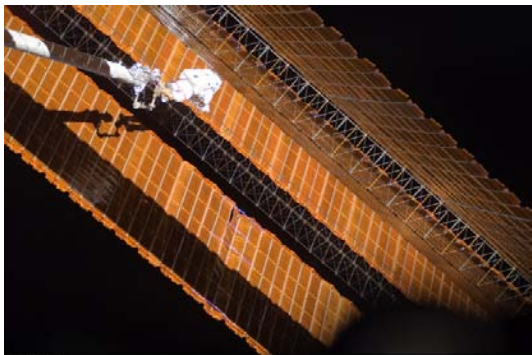
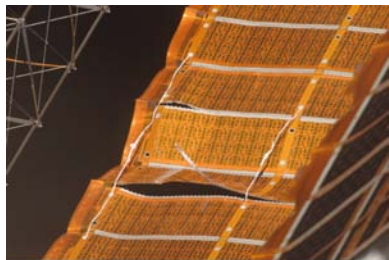
Page 2-182 - STS-120/10A

| FLT NO.   | ORBITER   | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET  | ORBIT   |   | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|--|---|--|--|--|---|---|---|--|---|
| STS-120/ISS 10A<br><br>SEQ FLT# 120<br><br>KSC-120<br><br>PAD 39A-43<br><br>MLP-2<br><br>23RD SHUTTLE FLIGHT TO ISS | OV-103 (Flight 34) DISCOVERY<br><br>OMS PODS: LPO1-37 RPO3-35 FRC3-34 | CDR: Pamela A. Melroy (Flt 3 - STS-92, STS-112) P740/R261/V175/F34<br><br>PLT: George Zamka P741/R315/M271<br><br>MS 1/EV1: Scott E. Parazynski (Flt 5 - STS-66, STS-86, STS-95, STS-100) P742/R187/V144/M165<br><br>MS 2/R: Stephanie D. Wilson (Flt 2 - STS-121) P743/R298/V190/F39<br><br>MS 3/EV2: Douglas H. Wheelock P744/R316/M272<br><br>MS 4/R: Paolo A. Nespoli (ESA) P745/R317/M273<br><br>MS 5 UP/EXP 16 FLT ENG: Daniel M. Tani (Flt 2 - STS-108) P746/R272/V191/M238<br><br>MS 5 DN/EXP 15/16 FLT ENG: Clayton C. Anderson (UP on STS-117, Stay on ISS) P747/R310/M268<br><br>SS EVA 110<br>DOCKED QUEST EVA 33 EMU/TETHERED EVA 103 SCHEDULED EVA 102 DURATION 6:14<br><br>Continued... | KSC 39A<br>296:15:38:19Z<br>11:38:19 PM EDT (P)<br>11:38:19 PM EDT (A)<br>Tuesday (16)<br>10/23/07 (12)<br><br>LAUNCH WINDOW: 7M 17S (PLT IN-PLANE)<br><br>EOM PLS: KSC<br>TAL: MRN<br>TAL WX: FMI<br><br>SELECTED: RTLS: KSC 15 N/N<br>TAL: MRN 20 N/N (ZZA: NO-GO)<br>AOA: NOR 35 N/N<br>1ST DAY PLS: EDW 04 C/N<br><br>TDEL: 0:00(P) 0.162(A)<br><br>MAX Q NAV: 719.02(P) 701.56(A)<br><br>SRB STG: 2:02.56(P) 2:03.20(A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN): 2:37 (P) 2:45(A)<br><br>NEG RETURN: 3:51 3:55<br><br>PTA (U/S 167 FPS): 5:16 5:26<br><br>SE TAL (ISTRES 104): 6:04 6:12<br><br>PTM (U/S 181 FPS): 6:16 6:27<br><br>Continued... | KSC 33 (KSC 66)<br>311:18:01:17Z<br>01:01:17 PM EST<br>Wednesday (15)<br>11/07/07 (12)<br><br>DEORBIT BURN: 311:16:58:49Z<br><br>XRANGE: 196 NM<br><br>ORBIT DIR: D/R 21<br><br>AIM PT: CLOSE IN<br><br>MLGTD: 1247 FT<br>311:18:01:17Z<br>VEL: 204 KGS 220 KEAS<br>HDOT: -5.4 FPS<br><br>TD NORM 195: 3249 FT<br><br>DRAG CHUTE DEPLOY: 189 KEAS<br>311:18:01:26Z<br><br>Continued... | 104/104/109%<br><br>PREDICTED: 100/104.5/ 104.5/72/ 104.5<br><br>ACTUAL: 100/104.5/ 104.5/72/ 104.5<br><br>1 = 2050 (6)<br>2 = 2048 (7)<br>3 = 2058 (2)<br><br>M 3 EOM:<br><br>WEIGHT: 203067 LBS<br><br>X CG: 1081.0 IN<br><br>LANDING: WEIGHT: 202989 LBS<br>X CG: 1083.0 IN | BI-131<br><br>RSRM 98<br><br>ET-120<br><br>SLWT 28<br><br>ET IMPACT<br><br>MET 1:14:06<br><br>LAT: 36.749S<br><br>LONG: 158.983W | 51.6 (23)<br><br>DIRECT INSERTION<br><br>POST OMS-2: 169.9X123.8 NM<br><br>DEORBIT: HA 188.0 NM HP 12.1 NM<br><br>ENTRY VELOCITY: 25850 FPS<br><br>ENTRY RANGE: 4436 NM | OI-32 (1)<br><br>CARGO: 40872 LBS<br><br>PAYLOAD CHARGEABLE: 33813 LBS<br><br>DEPLOYED: 33474 LBS<br><br>NON-DEPLOYED: 280 LBS<br><br>MIDDECK: 59 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS: DEPLOYED: 1362928 LBS<br>NON-DEPLOYED: 1598100 LBS<br><br>CARGO TOTAL: 3822037 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 2651 FUEL BIAS: 1063 FINAL TDDP: 2091 RECON: 1880<br><br>PAYLOADS: PLB: ISS 10A (NODE 2), PDGF, MBSU, SASA<br><br>MIDDECK: ISS 10A RAMBO MAUI<br><br>5 CRYO TK SETS<br><br>RMS 77 ODS, OBSS | <b>BRIEF MISSION SUMMARY: STS-120/10A (23<sup>rd</sup> ISS mission)</b> provided for expansion of the ISS with delivery of the Italian-built U.S. multi-port Node 2 connecting module named Harmony. Installation of Harmony allows for attachment of research labs from the European Space Agency (Columbus) and the Japan Aerospace Exploration Agency (Kibo) to be delivered on subsequent flights. The P6 truss segment and solar arrays were replaced from a temporary location (on Z1) to a permanent location on P5 truss. In this new location, the solar arrays were redeployed to maximize needed power generation for inclusion of the future research labs. Also on this mission, a 1-day extension was added to extend EVA 4 for starboard SARJ inspections, but the EVA was later reworked for a successful repair of P6 4B solar power array damaged during deploy.<br><br>KSC W/D: OPF 234, VAB 7, PAD 23 = 264 Total Work Days (OPF Processing occurred over a total time period of 273 days.)<br><br>LAUNCH POSTPONEMENTS:<br>- Added STS-120 to FDRD - launch date of 02/19/04 on 01/23/03.<br>- Postponed to NET 09/23/04 on 03/13/03 due to Columbia accident.<br>- Deleted flight from FDRD on 05/28/03.<br>- Re-baselined to NET 08/09/07 on 06/01/06.<br>- Postponed to NET 09/07/07 on 11/02/06. Slip due to ET delivery/processing schedule<br>- Advanced to 08/26/07 on 02/08/07 to avoid spacing problem with Soyuz and ATV.<br>- Postponed to 10/20/07 on 04/16/07. Slip due to STS-117 rollback.<br>- Postponed to 10/23/07 on 08/07/07. Slip to maintain standard minimum interval between Soyuz undocking (changed for landing opportunities) and orbiter docking to the ISS.<br><br>LAUNCH SCRUBS: None<br><br>LAUNCH WINDOW:<br>- Total launch window was 11 minutes 19 seconds with window open at 296:15:34:17Z and close at 296:15:45:36Z. Preferred Launch Time was 296:15:38:19Z (In-Plane Time) for a launch window of 7m17s.<br><br>LAUNCH DELAYS:<br>- None. Launch occurred on time at 296:15:38:19Z, 11:38:19 AM EDT on Tuesday, 10/23/07. (PAO: "It's a nice day in Florida...")<br><br>Continued... |  |   |



S120-E-006397 (25 Oct. 2007) --- Historical first space meeting of female Women Commanders. Peggy Whitson (right), ISS EXP 16 CDR, greets Pam Melroy, STS-120 CDR.

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (6+1 UP/6+1 DN)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.                          | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT F-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|---|---------|---|--|---|--|------------------------|------------------------|--|-----|--|---|--|
| STS-120/ISS 10A<br>Continued...   |         | Continued...<br><br>SS EVA 111<br>DOCKED QUEST EVA 34<br>EMU/TETHERED EVA 104<br>SCHEDULED EVA 103<br>DURATION 6:33<br><br>SS EVA 112<br>DOCKED QUEST EVA 35<br>EMU/TETHERED EVA 105<br>SCHEDULED EVA 104<br>DURATION 7:08<br><br>SS EVA 113<br>DOCKED QUEST EVA 36<br>EMU/TETHERED EVA 106<br>SCHEDULED EVA 105<br>DURATION 7:19 | Continued...<br><br><u>SE PRESS 104</u><br>7:06 6:57<br><br><u>MECO CMD:</u><br>8:25.6 8:25.8<br><br><u>VI:</u><br>25819 25817<br><br><u>OMS-2:</u><br>37:22 37:19.6<br>232.8 FPS230.9 FPS   | Continued...<br><br>NLGTD: 5419 FT<br>311:18:01:30Z<br>VEL: 150 KGS<br>163 KEAS<br>HDOT: -5.9 FPS<br><br>BRK INIT: 109 KGS<br><br><u>DRAG CHUTE JETTISON:</u><br>52 KGS<br>311:18:01:53Z<br><br><u>BRK DECEL FPS<sup>2</sup>:</u><br>AVE 6.3 PK 10.5<br><br><u>WHEELS STOP:</u><br>311:18:02:11Z<br>9593 FT<br><br><u>ROLLOUT:</u><br>8346 FT<br>54 SEC<br><br><u>WINDS:</u><br>10.6H 2.8R KTS<br>OFFICIAL:<br>35013P22 KTS<br>21H 6R KTS<br><br><u>DENS ALT:</u><br>771 FT<br><br><u>FLT DURATION:</u><br>15:02:22:58<br><br><u>S/T:</u> 1124:12:24:39<br><br><u>OV-103:</u><br>291:13:57:03<br><br><u>DISTANCE:</u><br>6,249,432 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>456,048,808 sm |  |                        |                        |  |     | Continued...<br><br><u>TAL WEATHER:</u><br>The weather model data for Europe continued to show an area of low pressure near Italy, with high pressure over central France. Windy conditions at ZZA and FMI were expected to contribute to pockets of turbulence in the region. Weakening high pressure was forecast over southern Spain, with partly cloudy skies and southwest winds at MRN Tuesday. All three TAL sites were forecast and observed GO. Moron was selected as Prime TAL Site.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: 1. PE Operational High Q TRN/OCT, 2. OMS Assist, 3. 52 nautical mile MECO, and 4. Del Psi.<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>On FD7, MMT concurred with adding a docked extension day to the mission to extend EVA 4 for starboard SARJ inspections for cause of vibrations and drag. |   |  |
| MCC WHITE FCR (50)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>A/E - N. D. Knight<br>LD/O1 - R. E. LaBrode<br>O2 (FD2-FD13) - M. P. Moses<br>O2 (FD1, FD14 and Waveoff) - M. R. Abbott<br>O3/PLNG (FD1-FD13) - M. L. Sarafin<br>PLNG (Prelaunch, FD1, FD14, and Waveoff - A. J. Ceccacci<br>ENT - B. C. Lunney<br>MOD - P. L. Engelauf<br>Team 4 - P. F. Dye<br><br>ISS:<br>LD/O2 - J. D. Hassmann<br>O1 - D. J. Weigel<br>O3/PLNG - H. L. Rarick<br>Team 4 - G. Kerrick<br><br><u>CAPCOMS:</u><br><u>SHUTTLE:</u><br>A/E - T. W. Virts<br>- L. J. Archambault (Wx)<br>LD/O1 - C. J. Ferguson<br>O2 - D. A. Antonelli<br>O3/Plng - S. W. Lucid<br>Team 4 - N/A<br><br>ISS:<br>LD/O2 - K. A. Ford<br>O1 - H. Getzelman<br>O3/PLNG - Z. Jones<br>Team 4 - N/A |         |   | <p>S120-E-007608 --- STS-120 &amp; Exp16 crews ISS Harmony node. From left (bottom): Anderson/MS (DN) , CDR Peggy A. Whitson, Yuri I. Malenchenko/FE/Exp16 (RSA) &amp; PLT Zamka. From left (center): Wilson/MS, CDR Pam Melroy, &amp; Nespoli/MS (ESA). From left (top): Daniel Tani/FE/Exp16 (UP), Parazynski/MS, &amp; Wheelock/MS.</p>  |   |  |                        |                        | <p>Continued...</p> <p><u>FIRSTS:</u></p> <ul style="list-style-type: none"><li>- Historical first meeting of two spacecrafts commanded by women: Peggy Whitson, the first woman to command the ISS, and Pamela A. Melroy, the second woman space shuttle commander.</li><li>- Successful first time operation of OV-103 Station-to-Shuttle Power Transfer System (SSPTS)</li><li>- First ET LO2 IFR bracket pockets filled with BX (replaces PDL in pockets) to minimize void formation.</li><li>- First flight of OI-32 Flight Software. Standard capability release included changes for enhanced crew safety and situational awareness, improved mated control of ISS, and other enhancements for ground and flight operations and safety.</li><li>- First High-definition TV coverage of Launch (by CNN)</li></ul> <p><u>NIGHT LAUNCH:</u> (N/A)</p> <p><u>RENDEZVOUS #68:</u> Rendezvous and dock with ISS</p> <p><u>EVENTS</u></p> <ul style="list-style-type: none"><li>- OMS 2 ignition at 296:15:48:44Z resulted in a 159.9 by 123.8 NM orbit.</li><li>- SRMS OBSS/LDRI survey of nosecap and port and starboard wing RCC (WLE's) was completed.</li><li>- TI maneuver at 298:09:55:25Z resulted in a 188.7 by 179.7 NM orbit.</li><li>- R-Bar Pitch Maneuver was performed. No significant issues</li><li>- Docking Capture occurred at 298:12:39:57Z.</li><li>- Hard Dock occurred at 298:12:52:50Z.</li></ul> <p>Continued...</p> |     |  |   |  |
| ISS016-E-008875<br>--- Close-up view of the repaired solar array.   |         |    | <p>ISS016-E-009207 (3 Nov. 2007) --- While anchored to a foot restraint on the end of the OBSS, Parazynski/EV1 assesses his repair work as the solar array is fully deployed during EVA 4.</p>   |   |  |                        |                        |  |     |  |   |  |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-184 - STS-120/10A

| FLT NO. | ORBITER | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG, THROTTLE PROFILE, ENG. S.N. | SRB RSRM, AND ET | ORBIT, INC, HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---------|---------|--|---|--|--|------------------|-------------------|--|-----|--|---|
|---------|---------|--|---|--|--|------------------|-------------------|--|-----|--|---|

STS-120/ISS 10A  
Continued...



**ABOVE:** In JSC MCC, Ed Gonzalez/Ascent Trajectory Officer monitors prelaunch data. **CENTER:** JSC2007-E-095148 --- In JSC MCC, FD Mike Moses (standing) escorted former President George H.W. Bush and former First Lady Barbara Bush shown talking to Shuttle & ISS crews on-orbit. **AT RIGHT:** JSC2007-E-097963---- On Nov.8 at Ellington Field, President George W. Bush greets returning CDR Melroy (pictured) and other crew members (out of frame) with JSC Director Mike Coats in the background.

Continued...

- ISS Hatch opened at 9:39 AM (CDT) on 10/25/07 (298:14:39:00Z) - Shuttle Crew welcomed by ISS Crew - Historical first meeting of two spacecrafts commanded by women.
- IELK Seat Liner Transfer at 298:16:12Z (11:12 AM CDT, Oct. 25, 2007). At that time Clayton Anderson became a member of STS-120 and Daniel Tani joined the ISS Expedition 16 as Flight Engineer.
- FD4 EVA 1: (EV1 and EV2) Removed the failed SASA from Z1; installed SASA in PLB sidewall carrier; prepped Node 2 (Harmony) for removal from bay; demated P6/Z1 fluid QD's; used Station robot arm (PDGF) to install Node 2 to temporary location on Node 1 (Unity). [NOTE: Node 2 was moved to its permanent location at the front of the U.S. Lab using the ISS robotic arm after shuttle departure.] EVA1 duration 6h14m
- FD6 EVA 2: EV1 and EV3 conducted P6 truss demate from temporary location on Z1; EV3 performed inspection of suspected sharp edge on S1 CETA rail; Initial stbd SARJ inspection: Node 2 Outfitting (EV1 completed all of this solo); structurally installed the Node 2 PDGF; successfully deployed the two outboard S1 radiators between EVA 2 and EVA 3 (so all three are now deployed). EVA 2 duration 6h33m
- FD7: MMT concurred with adding a docked extension day to the mission to extend EVA 4 for starboard SARJ inspections for cause of vibrations and drag.
- FD8 EVA 3: EV1 and EV2 attached P6 truss to P5 (permanent location). The 2B solar array was 100% deployed. The 4B array was aborted at 25 bays, with a tear in the right blanket (guide wire snag). EVA 3 duration 7h 8m
- FD11: MMT concurred with new plan for EVA4 to repair the Solar Array Wing (SAW) 4B repair. The Tile Ablator Dispenser DTO was postponed.
- FD12 EVA 4: (EV1 & EV2) EV1 repaired the P6 4B array using the OBSS on the SSRMS with a WIF-E. As reported by the Rocky Mountain News: "Parazynski...performed what NASA is calling on e of the greatest 'space saves' in the history of manned spaceflight. ...[He] floated outside with wire cutters, pliers, and homemade tools to fix the torn wing" [restoring maximum power capability to the ISS.] EVA 4 duration 7h 19m
- Transfers:
  - Hardware transferred ISS (outside and inside): 33,834 lbs
  - Hardware/supplies returned from ISS: 2,020 lbs
  - Water delivered to ISS: 939.1 lbm
  - Oxygen transferred to ISS: 30 lbm
  - Nitrogen transferred to ISS: 31.6 lbs
  - Power from ISS to Orbiter using SSPTS: 1186 kWh.
- FD14: Undocking from ISS: 309:10:32:03Z (4:32 am CST, 11/05/07)
- Sep 1 & Sep 2 maneuvers resulted in orbit 189.6 by 181.9 nm.
- Micrometeoroid Orbital Debris late inspection was completed. No issues.
- Anderson returned home after 152 days in space.
- Communications blackout time during Entry: 1m



S120E008531

S120-E-008531 (5 Nov. 2007) --- Back-dropped by the blackness of space and Earth's horizon, the new ISS configuration is viewed from the departing STS-120 Discovery.

## SIGNIFICANT ANOMALIES:

### Orbiter:

- V070-396376-201, Blanket R&R
- Protrusion on the Arrowhead Plate (H=0.38)
- Protruding Ames Gap Filler (H=0.21 & H=0.29)
- Blanket is lifted off left (Port) OMS Pod
- The MPS Engine #1 LO<sub>2</sub> Inlet Temperature failed off scale high at 15:41:15GMT during STS-120 Ascent.
- On STS-120/OV-103, Measurement V62T0519A was erratic, diverged from approximately 184 degrees F
- Missing debris

### SRB:

- Nonlinear separation on LH SRB of the Frustrum/Forward Skirt Ordnance Ring for STS-120/BI-131
- STS-120/ET-120 launched on 10/23/07: Post Launch camera and film review showed loss of foam at two locations.

### RSRM:

- Gas penetrations through Nozzle Joint 2 RTV, RSRM-98A&B
- Gas penetration through RTV, Nozzle Joint 5, RSRM-98B

### SSME: None

### ET: None

### MOD:

- Missing step in PDRS STBD survey procedure
- Typo - IMU align in Orb Ops Checklist
- RMS Joint Angle Ground Display Error

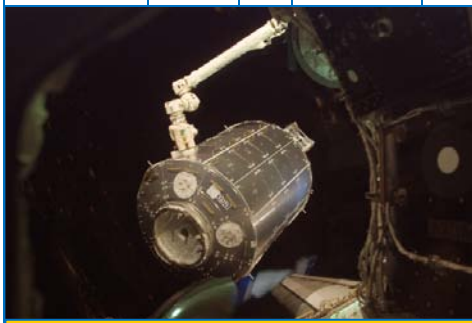
### INTEGRATION:

- LH<sub>2</sub> Umbilical ice noted prelaunch
- GUCP ice bridged to ET Inter-tank Foam
- ET LH<sub>2</sub> Tank foam acreage losses
- Unexpected debris/expected debris exceeding mass allowable prior to pad clearance (liftoff debris)
- Debris release on outboard side of LO<sub>2</sub> Feedline at ~277 sec MET

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-185 - STS-122/1E

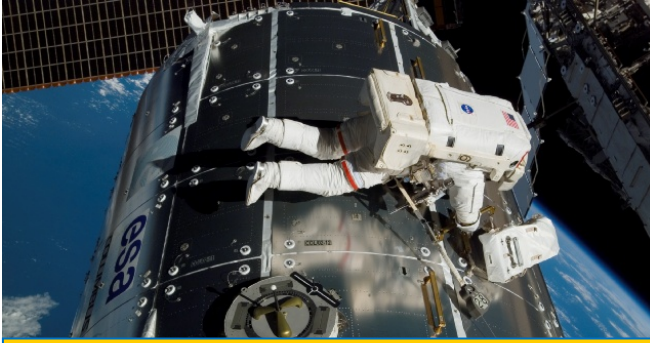


| FLT NO.  | ORBITER   | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES, & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET   | ORBIT<br>INC HA/HP |  | FSW          | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|---|--|--|---|---|--|--------------------|--|--------------|--|--|
| STS-122/<br>ISS 1E<br><br>SEQ<br>FLT# 121<br><br>KSC-121<br><br>PAD 39A-44<br><br>MLP-1<br><br>24TH<br>SHUTTLE<br>FLIGHT TO<br>ISS | OV-104<br>(Flight 29)<br>ATLANTIS<br><br>OMS PODS:<br>LPO4-29<br>RPO1-36<br>FRC4-29 | CDR:<br>Stephen N. Frick<br>(Flt 2 - STS-110)<br>P748/R276/V192/M242<br><br>PLT:<br>Alan G. Poindexter<br>P749/R318/M274<br><br>MS 1/R:<br>Leland D. Melvin<br>P750/R319/M275<br><br>MS 2/EV1:<br>Rex J. Walheim<br>(Flt 2 - STS-110)<br>P751/R277/V193/M243<br><br>MS 3/EV2:<br>Hans Schlegel (Germany)<br>(Flt 2 - STS-55)<br>P752/R163/V194/M143<br><br>MS 4/EV3:<br>Stanley G. Love<br>P753/R320/M276<br><br>MS 5 UP/EXP 16 FLT ENG:<br>Leopold Eyharts (ESA)<br>(also flew on MIR Feb 1998)<br>P754/R321/M277<br><br>MS 5 DN/EXP 16 FLT ENG:<br>Daniel M. Tani<br>(Flt 2 - STS-108, STS-120<br>up)<br>P755/R272/V191/M238<br><br>SS EVA 114<br>DOCKED QUEST EVA 37<br>EMU/TETHERED EVA 107<br>SCHEDULED EVA 106<br>DURATION 7:58<br><br>SS EVA 115<br>DOCKED QUEST EVA 38<br>EMU/TETHERED EVA 108<br>SCHEDULED EVA 107<br>DURATION 6:45<br><br>Continued... | KSC 39A<br>038:19:45:30Z<br>2:45:30 PM EST (P)<br>2:45:30 PM EST (A)<br>Tuesday (35)<br>2/07/08 (9)<br><br>LAUNCH WINDOW:<br>5M1S<br>(PLT IN-PLANE)<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN, BEN<br><br>SELECTED:<br>RTLS: KSC 15 N/N<br>TAL: ZZA 30L N/N<br>AOA: NOR 23 N/N<br>1ST DAY PLS:<br>EDW 04 N/N<br><br>TDEL:<br>0:000(P) 0.212(A)<br><br>MAX Q NAV:<br>756.21(P) 755.17(A)<br><br>SRB STG:<br>2:04.16(P) 2:04.16(A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN):<br>2:35(P) 2:38(A)<br><br>NEG RETURN:<br>3:51 3:54<br><br>PTA (U/S 161 FPS):<br>5:04 5:05<br><br>SE TAL (ZZA 104):<br>6:04 6:082<br><br>PTM (U/S 167 FPS):<br>5:58 6:02<br><br>Continued... | KSC 15 (KSC 67)<br>051:14:07:09Z<br>9:07 AM EST<br>Thursday (11)<br>02/21/08 (7)<br><br>DEORBIT BURN:<br>051:12:59:52.0Z<br><br>X RANGE: 408 NM<br><br>ORBIT DIR: AL 38<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2344 FT<br>051:14:07:09Z<br>VEL: 197 KGS<br>194 KEAS<br>HDOT: -2.1 FPS<br><br>TD NORM 195:<br>2200 FT<br><br>DRAG CHUTE<br>DEPLOY:<br>188 KEAS<br>051:14:07:10Z<br><br>NLGTD: 5175 FT<br>051:14:07:17Z<br>VEL: 157 KGS<br>155 KEAS<br>HDOT: -4.9 FPS<br><br>BRK INIT: 91 KGS<br><br>DRAG CHUTE<br>JETTISON:<br>54 KGS<br>051:14:07:46Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.6 PK 6.9<br><br>WHEELS STOP:<br>051:14:08:07Z<br>10911 FT<br><br>ROLLOUT:<br>8567 FT<br>58 SEC<br><br>Continued... | 104/104/109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72/<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/74/<br>104.5<br><br>1 = 2059 (2)<br>2 = 2052 (6)<br>3 = 2057 (3)<br><br>M 3 EOM:<br><br>WEIGHT:<br>207295 LBS<br><br>X CG:<br>1078.2 IN<br><br>LANDING:<br><br>WEIGHT:<br>207215 LBS<br><br>X CG:<br>1080.4 IN | BI-132<br><br>RSRM<br>99<br><br>ET-125<br><br>SLWT<br>29<br><br>ET<br>IMPACT<br><br>MET<br>1:14:07<br><br>LAT:<br>36.619S<br><br>LONG:<br>158.796W | 51.6<br>(24)       | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>124.0X118.8 NM<br><br>DEORBIT:<br>HA 187.6 NM<br>HP 23.1 NM<br><br>ENTRY<br>VELOCITY:<br>25860 FPS<br><br>ENTRY<br>RANGE:<br>4403 NM | OI-32<br>(2) | CARGO:<br>40296 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>32941 LBS<br><br>DEPLOYED:<br>30657 LBS<br><br>NON-DEPLOYED:<br>2162 LBS<br><br>MIDDECK:<br>122 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1393585 LBS<br><br>NON-DEPLOYED:<br>1600348 LBS<br><br>CARGO TOTAL:<br>3862333 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 2651<br>FUEL BIAS: 1063<br>FINAL TDDP: 2402<br>RECON: 3435<br><br>PAYLOADS:<br>PLB:<br>ISS 1E<br>(COLUMBUS<br>MODULE)<br>ICC-LITE<br>ECSS<br>PDGF<br><br>MIDDECK:<br>ISS 1E<br>MAUI<br><br>5 CRYO TK SETS<br><br>RMS 78<br><br>ODS<br>OBSS<br>SSPTS | <b>BRIEF MISSION SUMMARY: STS-122/1E (24<sup>th</sup> ISS mission)</b><br><b>delivered the European Space Agency's Columbus</b><br><b>research laboratory module to the ISS. Columbus,</b><br><b>measuring 23 ft in length and 15 ft in diameter, is ESA's</b><br><b>largest contribution to the expansion of the ISS. Also</b><br><b>delivered were ESA experiments and two ESA astronauts</b><br><b>with one of them to join the ISS crew for operation of</b><br><b>Columbus research. This mission also saw the Columbus</b><br><b>Control Center in Oberpfaffenhofen, near Munich, Germany,</b><br><b>brought on-line for initial checkout and future operations of</b><br><b>the laboratory.</b><br><br>KSC W/D: OPF: 121, VAB HB-3: 7, PAD A: 76 = 204 Total Work<br>Days (+1 holiday @ OPF Processing + 10 holidays + 4<br>contingency days @ PAD)<br><br>LAUNCH POSTPONEMENTS:<br>- Added STS-122 to FDRD - Launch date of 10/17/07 on 10/05/06.<br>- Postponed to 12/06/07 on 04/16/07 due to STS-117 rollback.<br>- After 12/06/07 scrub, see LAUNCH SCRUBS below, launch was<br>reset for 24-hr turnaround on Friday, 12/07/07.<br>- Later, on 12/06/07, during MMT Scrub Turnaround Meeting, it<br>was decided to extend to a 48-hr turnaround for Saturday,<br>12/08/07 launch to allow additional time to address all concerns.<br>- At Friday, 12/07/07 MMT, it was determined that necessary<br>discussion could not be finished in time for Saturday 12/08/07<br>launch attempt. The launch was moved to Sunday 12/09/07<br>with a new Launch Commit Criteria (for this launch only)<br>requiring four of four valid ECO sensor readings (rather than<br>three of four) prior to launch. In addition, the following two<br>conditions were added: 1) Launch Window was limited to in-<br>plane +1 minute (to provide additional ascent fuel margin), and<br>2) utilization of new in-flight ECO circuit voltage readings<br>(successfully tested on STS-118 and STS-120 by ground flight<br>controllers to recommend manual engine shutdown by the crew,<br>if required.<br>- After second scrub on 12/09/07, see LAUNCH SCRUBS below,<br>launch was rescheduled to NET 01/02/08 contingent on<br>development and implementation of fuel ECO sensor system<br>troubleshooting plan.<br>- Postponed to 01/10/08 on 12/13/07 dependent on resolution of<br>the problem with the fuel sensor system. Slip was to allow "as<br>many people as possible to have time with family and friends at<br>the time of year when it means the most." Tanking test using<br>add-on Time Domain Reflectivity (TDR) instrumentation on<br>12/18/07 isolated ECO Sensor System failures to open circuit in<br>the three-part "pass-through connector." TPS removal on the<br>tank was authorized at the pad to begin moving toward removal<br>of the hardware, if required, to solve the problem. Launch date<br>remained unchanged.<br>- Postponed to TBD on 01/03/08; however, PRCB established a<br>"work to" launch date of 02/02/08 dependent on testing of<br>removed ECO connector, installation of replacement connector,<br>and replacement and retesting procedures of Ascent Thrust<br>Vector Control (ATVC) unit.<br><br>Continued... |



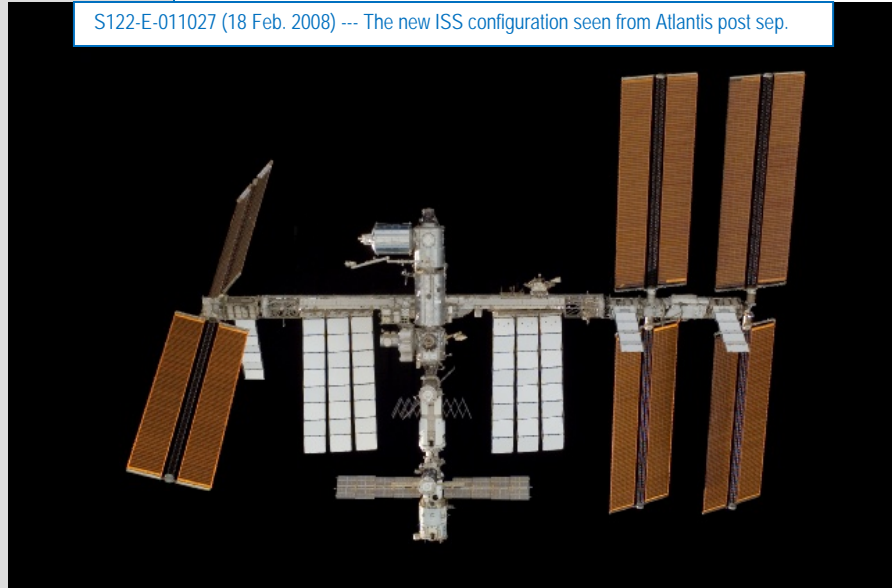

S122-E-007873 (11 Feb. 2008) --- Photographed from ISS, the station's robotic Canadarm2 moves the Columbus laboratory from Atlantis' payload bay to the starboard side of the Harmony module.



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES, & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.                                 | SRB RSRM AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|---|---------|--|--|--|--|-----------------|-------|--|-----|---|---|--|
| STS-122/ISS 1E<br>Continued...  |         | Continued...<br><br>SS EVA 116<br>DOCKED QUEST EVA 39<br>EMU/TETHERED EVA 109<br>SCHEDULED EVA 108<br>DURATION 7:25<br><br>MCC WHITE FCR (51)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>ASC - N. D. Knight<br>LD/O1 - M. L. Sarafin<br>O2 - A. J. Ceccacci<br>PLNG - P. F. Dye<br>ENT - B. C. Lunney<br>MOD - P. L. Engelauf<br>Team 4 - M. R. Abbott<br><br>ISS:<br>LD/O2 - S. P. Davis<br>O1 - R. C. Dempsey<br>O3 - J. R. Spencer<br>Team 4 - K. L. Alibaruho<br>IP FD - A. P. Hasbrook<br>(I/F w/Columbus CC, Oberpfaffenhofen, Germany) | Continued...<br><br><u>SE PRESS 104</u><br>6:55 6:55<br><br><u>MECO CMD:</u><br>8:22.9 8:22.8<br><br><u>VI:</u><br>25819 25818<br><br><u>OMS-2:</u><br>37:46 37:40<br>159.6 FPS158.1 FPS | Continued...<br><br><u>WINDS:</u><br>1.9T 0.6R KTS<br><u>OFFICIAL:</u><br>31003P05 KTS<br>5H 2L KTS<br><br><u>DENS ALT:</u><br>77 FT<br><br><u>FLT DURATION:</u><br>12:18:21:39<br><u>S/T:</u> 1137:06:46:18<br><u>OV-104:</u><br>258:07:05:40<br><u>DISTANCE:</u><br>5,296,842 sm<br><br><u>TOTAL SHUTTLE</u><br><u>DISTANCE:</u><br>461,345,650 sm |  |                 |       |  |     | Continued...<br><br>- New "work to" launch date of NET 02/07/08 established on 01/14/08. Testing of removed ECO connector confirmed problem in the connector.<br>- Officially postponed launch to 02/07/08 on 01/28/08. Slip was due to ECO sensor problems experienced during December launch attempt and implementation of ECO sensor connector soldered mod. (Also, LCC went back to the standard three of four valid ECO sensor readings.)<br><br><u>LAUNCH SCRUBS:</u><br>- Thursday, 12/06/07 launch attempt was terminated 2 hours into tanking when two of four engine cutoff (ECO) low-level LH2 fuel sensors failed wet/dry test. (The 5% sensor also failed wet during drain-back.) The ECO sensors are required for backup engine shutdown command to avoid catastrophic failure in the event of early fuel depletion. Launch was scrubbed at 8:56 am CST. Technical Scrub.<br>- Sunday, 12/09/07 launch attempt was terminated when one of previously failed sensors failed again during tanking, a couple of minutes into fast-fill. Engineers stated that the ET feedthrough and connector assembly was the most likely source of the problems. The 12/06/07 and 12/09/07 launch attempts produced previously unavailable time trending data that showed sensor faults occurring shortly before and after the feedthrough and connector were immersed in the super-cold propellants. Technical Scrub.<br><br><u>LAUNCH WINDOW:</u><br>- Total launch window was 10m1s with window open at 038:19:40:29Z and close at 038:19:50:30Z. Preferred Launch Time was 038:19:45:30Z (In-Plane Time) for a launch window of 5m1s.<br><br><u>LAUNCH DELAYS:</u><br>- None. Launch occurred on time at 038:19:45:30Z, 1:45:30 PM CST on Thursday 02/07/08.<br><br><u>TAL WEATHER:</u><br>Weather for the Transoceanic Abort Landing (TAL) sites during launch was benign. High pressure at the surface and aloft produced clear skies and light winds for Moron, Spain (MRN), Zaragoza, Spain (ZZA), and Istres, France (ISTRES). All three TAL sites were forecast GO throughout the launch count. |   |  |
| CAPCOMS:<br><u>SHUTTLE:</u><br>A/E - J. P. Dutton<br>- T. W. Virts (Wx)<br>LD/O1 - K. A. Ford<br>O2 - S. K. Robinson<br>PLNG - S. W. Lucid<br>Team 4 - N/A<br><br>ISS:<br>O1 - H. Getzelman<br>LD/O2 - C. J. Cassidy<br>O3/PLNG - C. E. Zajac<br>Team 4 - N/A |         |   |  |  |  |                 |       |  |     |   |   |  |
|   |         |   |  |  |  |                 |       |  |     |   |   |  |
|   |         | S122-E-008911--- Schlegel/MS (ESA Germany) continues work aimed toward readying the new Columbia lab for duty  |  |  |  |                 |       |  |     |   |   |  |
|   |         | S122-E-009694-- STS-122 & EXP 16 crews in ISS Zvezda SM: STS CDR Frick (bottom left), Walheim/MS (bottom center), Melvin/MS (bottom right), Exp 16 CDR Peggy Whitson, Love/MS (above Whitson), STS PLT Poindexter (top right), Tani/MS (top left), Leopold Eyharts EXP FE (ESA) (left middle), Schlegel/MS (Germany), Yuri I. Malenchenko/EXP FE (RSA) is above Walheim.   |  |  |  |                 |       |  |     |   |   |  |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (6+1 UP/6+1 DN)<br><br>TITLE, NAMES, & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|---|--|---|---|-----------------|------------------------|--|-----|--|---|
| STS-122/ ISS 1E<br>Continued...  |         |   | <div>S122-E-011027 (18 Feb. 2008) --- The new ISS configuration seen from Atlantis post sep.</div>  <div>S122E011027</div> |   |   |                 |                        |  |     | <p>Continued...</p> <p><b>PERFORMANCE ENHANCEMENTS:</b><br/>Include the standard set plus: 1) PE Operational High O WIN/FEB, 2) OMS Assist, 3) a 52 nm MECCO, and 4) Del Psi.</p> <p><b>FLIGHT DURATION CHANGES/LANDING:</b><br/>On FD4, MMT concurred with formally changing mission duration from 11+1+2 to 12+0+2 to honor ISSP request for extra docked day for commissioning Columbus. (Activity did not fit 11-day mission.)</p> <p>On FD7, MMT concurred with extending the mission duration to 13+0+2 to provide additional time needed to complete the activation of the Columbus module. Landing day was moved to 02/20/08.</p> <p><b>FIRSTS/LASTS:</b></p> <ul style="list-style-type: none"><li>- First flight ECO sensor connector soldered mod</li><li>- First flight of new RSRM Nozzle-to-Case J-leg Joint insulation configuration</li><li>- New Annex Flight Rule in place to outline operational use of ECO sensor voltage measurements</li><li>- Addition of the Modified Adjustable Protective Mitten Assemblies (APMA's) or Overgloves</li><li>- First operational support from the Columbus Control Center in Oberpfaffenhofen, Germany</li><li>- First reboost of ISS since December 2002</li><li>- Last Shuttle Mission for Shuttle Program Manager N. Wayne Hale, Jr., a 30-year veteran of NASA who helped lead the space agency's recovery from the 2003 Columbia Disaster.</li></ul> <p><b>MENTENTOS:</b></p> <ul style="list-style-type: none"><li>- Mementos carried aboard STS-122 included three green starter flags celebrating the 50th anniversary of NASA and the 50th running of the Daytona 500 NASCAR Race, a dried red rose to be woven into a NASA-themed 50th anniversary float for the Tournament of Roses Parade, and 20 ESA flags whose use will be to commemorate the addition of Columbus to the ISS.</li></ul> <p><b>NIGHT LAUNCH:</b> N/A</p> <p><b>RENDEZVOUS #69:</b> Rendezvous and dock with ISS</p> <p><b>EVENTS:</b></p> <ul style="list-style-type: none"><li>- OMS 2 Ignition at 038:20:23:09.9Z resulted in a 124.4 by 118.7 nm orbit.</li><li>- SRMS OBSS/LDRI survey of nosecap and port and starboard wing RCC (WLE's) was completed.</li><li>- T1 maneuver at 040:14:37:28Z resulted in a 184.0 by 176.0 nm orbit.</li><li>- R-Bar Pitch Maneuver was performed. No significant issues</li><li>- Docking Capture occurred at 040:17:17:20Z.</li><li>- Hard Dock occurred at 040:17:30:22Z (above the South Australian coast - Columbus reached its permanent home).</li><li>- ISS Hatch Open 12:40 PM CST, Saturday, 02/09/08 - welcomed by ISS Crew.</li></ul> <p>Continued...</p> |   |
|  <p>JSC2008-E-010344 --- FD's Norm Knight (left), Bryan Lunney, &amp; Richard Jones monitor data in the Space Shuttle FCR of JSC's MCC during launch countdown activities a few hundred miles away at KSC.</p>  |         |   |  |   |   |                 |                        |  |     |  |   |
|  <p>JSC2008-E-010460 (8 Feb. 2008) --- John Shannon (right), Deputy Shuttle Program Manager; and Mike Sarafin, Lead Shuttle Flight Director, participate in an STS-122 press briefing with news media representatives at JSC. Rob Navias, PAO, (left) serves as moderator for the briefing.</p> |         |   |  |   |   |                 |                        |  |     |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-188 - STS-122/1E

| FLT NO.                         | ORBITER  | CREW (6+1 UP/6+1 DN)<br><br>TITLE, NAMES, & EVA'S | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N. | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---------------------------------|--|---|--|---|---|------------------------|------------------------|--|-----|---|---|
| STS-122/ ISS 1E<br>Continued... |   |   |  |   |   |                        |                        |  |     |   | <p>Continued...</p> <ul style="list-style-type: none"><li>- IELK Seat Liner Transfer at 040:23:20Z (5:20 PM CST, Feb. 9, 2008). At that time Daniel Tani became a member of STS-122 and Leopold Eyharls/ESA joined the ISS Expedition 16 as Flight Engineer.</li><li>- Due to crew health issue, EVA1 postponed from FD4 to FD5</li><li>- FD5 EVA 1: EV1 and EV3 (sub for EV2, health issue) performed Columbus prep activities: connected data, power, and communications lines; removed LTA cable and CBM seal cover; installed PDGF; performed NTA prep activities; and stowed OTSD. Columbus second stage bolting completed at 3:44 PM CST Monday, 02/11/08. EVA1 duration 7h58m</li><li>- FD7 EVA 2: EV1 and EV2 completed primary task to R&amp;R a spent Nitrogen Transfer Assembly, outfit Columbus with trunnion covers, and repair Lab MMOD shield. EVA 2 duration 6hr45m</li><li>- The OMS Pod stinger tile was cleared for entry.</li><li>- FD9 EVA 3: EV1 and EV3 transferred SOLAR to Columbus, installed Columbus keel pin cover and handrail, transferred CMG to PLB, transferred EuTEF, and performed Airlock handrail damage swatch test. EVA 3 duration 7h25m</li><li>- EVA NOTE: One EMU glove from STS-122, S/N 6197, had a 3/16-inch hole in the Vectran of left thumb that wasn't seen until postflight inspections on the ground. S/N 6197 was Rex Walheim's left glove worn on all three EVA's (per STS-123 03/11/08 MMT notes).</li><li>- European Flight Controllers told the crew they had successfully completed initial activation of Columbus with the module's computer systems. German Chancellor Angela Merkel called to congratulate the crew.</li><li>- FD9: To clear the path to shoot down a crippled spy satellite, NASA agreed to open its California landing strip on Wednesday, 02/20/08 so Atlantis could land that day, even if weather was bad at KSC. "The reason is to give the military the biggest possible window and maximum flexibility to ensure the success of the satellite intercept" per Lead Shuttle Flight Director Sally Davis.</li><li>- Transfers:<ul style="list-style-type: none"><li>• Hardware transferred to ISS (outside and inside): 30404 lbs</li><li>• Columbus - ESA Laboratory: 26627 lbs</li><li>• Hardware/supplies transferred from ISS: 3585 lbs</li><li>• H<sub>2</sub>O transferred to ISS: 1386 lbs</li><li>• O<sub>2</sub> transferred to ISS: 95 lbs</li><li>• N<sub>2</sub> transferred to ISS: 27 lbs</li></ul></li><li>- FD10: Reboost at 047:12:17:00.OZ resulted in 187.8 by 177.6 nm orbit (first reboost since December 2002). ISSP estimated prop savings to get 400 lbs of logistics gains.</li><li>- Undocked at 049:09:24:40Z followed by a flyaround (1/2 lap)</li><li>- Separation Burn 1 at 049:10:34:02.OZ resulted in 188.1 by 175.8 nm orbit</li><li>- Separation Burn 2 at 049:11:01:30.OZ resulted in 187.9 by 175.5 nm orbit</li><li>- No communications blackout during Entry.</li></ul> |
|                                 | <p>ABOVE: JSC2008-E-012993 --- The STS-122 Orbit 1 Flight Control Team pose for a portrait in the Space Shuttle FCR at the JSC MCC. Flight Director Mike Sarafin (center right) holds the STS-122 mission logo.</p> <p>BELOW: JSC2008e020392 --STS-122 Ascent FCT poses with the crew in JSC MCC. FD Norm Knight (left) &amp; CAPCOM Jim Dutton hold the mission logo. Crew pictured are CDR Frick, PLT Poindexter, Melvin/MS, Walheim/MS, &amp; Schlegel/MS. (Not pictured was Love/MS.)</p>  |   |  |   |   |                        |                        |  |     |   |   |

**NOTES:**

- Landing occurred at KSC on Wednesday 02/20/08 at 9:07 AM EST, 46 years to the day after the first American, John Glenn, orbited the Earth.
- Daniel Tani returned home after 120 days.

**SIGNIFICANT ANOMALIES:**

**Orbiter:**

- Overexposed video due to suspect AVIU
- Fuel Cell 3 O<sub>2</sub> flowmeter is erratic.
- During flight, Port AFT MPM Pedestal Stow indications came on approximately 11 hours after actual stow.
- SSOR #1 intermittent comm dropouts
- Suspect indication of possible IML crack on noted tile
- CCTV black and white video shows intermittent color.
- Mid Port Payload Bay Floodlight not illuminating

**SRB:**

- One of the three main parachutes on BI-132 LH showed significant damage in the canopy.

**RSRM:**

- Missing piece of forward factory joint weather seal, RSRM-99B

**SSME: None**

**ET:**

- ET-124 - Post Launch camera and film review showed LH2 acreage foam loss at Sta. 1160 during Launch.
- A crack in the +Y SRB Pal Ramp was observed prior to the ET-125 tanking test on 12/18/07.
- A crack in the +Y Longeron Closeout was observed during the post-drain walkdown after the ET-125 tanking test on 12/18/07.
- During the first launch attempt of ET-125 on 12/06/07, ECO/S #3 and #4 failed wet.
- STS-122/ET-125 launched on 02/07/08. Post Launch camera and film review showed LH<sub>2</sub> acreage foam loss at Sta. 1145 during Launch.
- STS-122/ET-125 - Post Launch camera and film review showed TPS losses at the intertank to LH<sub>2</sub> flange closeout at two locations.

**MOD:**

- High-speed data dropouts during Launch
- Trajectory Server GPS time misconfiguration




**Integration:**

- Stinger tile observed falling after SSME startup
- Ku-Band radiated in Hi Power
- Unexpected debris/expected debris exceeding mass allowable prior to pad clearance (liftoff debris)
- I/T to LH<sub>2</sub> Flange closeout foam loss
- 2 locations of red foreign material located on SRB
- LO<sub>2</sub> Umbilical Cable Tray foam loss (aft of Xt-2058)
- STS-122 LH<sub>2</sub> ECO failure
- LH2 acreage loss adjacent to Xt 1129 LO<sub>2</sub> Feedline base closeout
- LH2 acreage loss aft of +Y bipod
- Missing/peeled SF-EPDM on RH Forward Segment Factory Joint

Continued...

- IELK Seat Liner Transfer at 040:23:20Z (5:20 PM CST, Feb. 9, 2008). At that time Daniel Tani became a member of STS-122 and Leopold Eyharts/ESA joined the ISS Expedition 16 as Flight Engineer.
- Due to crew health issue, EVA1 postponed from FD4 to FD5
- **FD5 EVA 1:** EV1 and EV3 (sub for EV2, health issue) performed Columbus prep activities: connected data, power, and communications lines; removed LTA cable and CBM seal cover; installed PDGF; performed NTA prep activities; and stowed OTSD. Columbus second stage bolting completed at 3:44 PM CST Monday, 02/11/08. EVA1 duration 7h58m
- **FD7 EVA 2:** EV1 and EV2 completed primary task to R&R a spent Nitrogen Transfer Assembly, outfit Columbus with trunnion covers, and repair Lab MMOD shield. EVA 2 duration 6hr45m
- The OMS Pod stinger tile was cleared for entry.
- **FD9 EVA 3:** EV1 and EV3 transferred SOLAR to Columbus, installed Columbus keel pin cover and handrail, transferred CMG to PLB, transferred EUTEF, and performed Airlock handrail damage swatch test. EVA 3 duration 7h25m
- **EVA NOTE:** One EMU glove from STS-122, S/N 6197, had a 3/16-inch hole in the Vectran of left thumb that wasn't seen until postflight inspections on the ground. S/N 6197 was Rex Walheim's left glove worn on all three EVA's (per STS-123 03/11/08 MMT notes).
- European Flight Controllers told the crew they had successfully completed initial activation of Columbus with the module's computer systems. German Chancellor Angela Merkel called to congratulate the crew.
- **FD9:** To clear the path to shoot down a crippled spy satellite, NASA agreed to open its California landing strip on Wednesday, 02/20/08 so Atlantis could land that day, even if weather was bad at KSC. "The reason is to give the military the biggest possible window and maximum flexibility to ensure the success of the satellite intercept" per Lead Shuttle Flight Director Sally Davis.
- **Transfers:**
  - Hardware transferred to ISS (outside and inside): 30404 lbs
  - Columbus - ESA Laboratory: 26627 lbs
  - Hardware/supplies transferred from ISS: 3585 lbs
  - H<sub>2</sub>O transferred to ISS: 1386 lbs
  - O<sub>2</sub> transferred to ISS: 95 lbs
  - N<sub>2</sub> transferred to ISS: 27 lbs
- **FD10:** Reboost at 047:12:17:00.0Z resulted in 187.8 by 177.6 nm orbit (first reboost since December 2002). ISSP estimated prop savings to get 400 lbs of logistics gains.
- Undocked at 049:09:24:40Z followed by a flyaround (1/2 lap)
- Separation Burn 1 at 049:10:34:02.0Z resulted in 188.1 by 175.8 nm orbit
- Separation Burn 2 at 049:11:01:30.0Z resulted in 187.9 by 175.5 nm orbit
- No communications blackout during Entry.

# SPACE SHUTTLE MISSIONS SUMMARY



| FLT NO.  | ORBITER                           | CREW (6+1 UP/6+1 DN)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM<br><br>AND ET   | ORBIT   |  | FSW   | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|-----------------------------------|--|--|--|---|--|---|--|---|---|---|
| STS-123/ISS 1JA  | OV-105 (Flight 21) ENDEAVOUR      | CDR: Dominic L. Gorie (Flt 4 - STS-91, STS-99, STS-108) P756/R242/V157/M211<br><br>PLT: Gregory H. Johnson P757/R322/M278<br><br>MS 1/EV2: Robert L. Behnken P758/R323/M279<br><br>MS 2/EV3: Michael J. Foreman P759/R324/M280<br><br>MS 3: Takao Doi, JAXA (Flt 2 - STS-87) P760/R231/V195/M201<br><br>MS 4/EV1: Richard M. Linnehan (Flt 4 - STS-78, STS-90, STS-109) P760/R214/V150/M187<br><br>MS 5 UP/EV4/EXP 16/17 FLT ENG: Garrett E. Reisman P761/R325/M281<br><br>MS 5 DN/EXP 16 FLT ENG: Leopold Eyharts, ESA (UP on STS-122, Stay on ISS. Also flew on MIR Feb 1998.) P762/R321/M277<br><br>SS EVA 117 DOCKED QUEST EVA 40 EMU/TETHERED EVA 110 SCHEDULED EVA 108 DURATION 7:01<br><br>SSA EVA 118 DOCKED QUEST EVA 41 EMU/TETHERED EVA 111 SCHEDULED EVA 109 DURATION 7:09<br><br>Continued... | KSC 39A 071:06:28:14Z 2:28:14 AM EDT (P) 2:28:14 AM EDT (A) Tuesday (17) 3/11/08 (9)<br><br>LAUNCH WINDOW: 4M54S (PLT IN-PLANE)<br><br>EOM PLS: KSC TAL: ZZA TAL WX: BEN<br><br>SELECTED: RTLS: KSC 15 N/N TAL: ZZA 30L N/N (MRN: NO-GO) AOA: NOR 23 N/N 1ST DAY PLS: EDW 04 N/N<br><br>TDEL: 0.000 (P) -0.288 (A)<br><br>MAX Q NAV: 754.38 (P) 758.53 (A)<br><br>SRB STG: 2:05.44 (P) 2:04.64 (A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA): 2:39 (P) 2:41 (A)<br><br>NEG RETURN: 3:54 (P) 3:55 (A)<br><br>PTA (U/S 158 FPS): 5:04 (P) 5:01 (A)<br><br>SE TAL (ZZA 104): 5:57 (P) 6:04 (A)<br><br>PTM (U/S 181 FPS): 6:05 (P) 6:03 (A)<br><br>SE PRESS 104: 6:56 (P) 6:57 (A)<br><br>Continued... | KSC 15 (KSC 68) 087:00:39:06Z 8:39:06 PM EDT Wednesday (16) 03/26/08 (9)<br><br>DEORBIT BURN: 086:23:33:13.9 Z<br><br>XRANGE: 187.7 NM<br><br>ORBIT DIR: A/R (14)<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2174 FT 087:00:39:06Z VEL: 202 KGS 200 KEAS HDOT: -1.8 FPS<br><br>TD NORM 195: 2707 FT<br><br>DRAG CHUTE: DEPLOY: 192 KEAS 087:00:39:10Z NLGTD: 5351 FT 087:00:39:16Z VEL: 161 KGS 158 KEAS HDOT: -4.6 FPS<br><br>BRK INIT: 57 KGS<br><br>DRAG CHUTE JETTISON: 58 KGS 087:00:39:55Z<br><br>BRK DECEL FPS <sup>2</sup> : AVE 2.7 PK 4.1<br><br>WHEELS STOP: 087:00:40:36Z 13629 FT<br><br>ROLLOUT: 11455 FT 1:30 M:S<br><br>Continued... | 104/104/109%<br><br>PREDICTED: 100/104.5/104.5/72/104.5<br><br>ACTUAL: 100/104.5/99/72/104.5<br><br>1 = 2047 (11) 2 = 2044 (10) 3 = 2054 (7)<br><br>M 3 EOM: WEIGHT: 208629.5 LBS X CG: 1080.57 IN<br><br>LANDING: WEIGHT: 208762 LBS X CG: 1081.8 IN | BI-133<br><br>RSRM 101<br><br>ET-126<br><br>SLWT 30<br><br>ET IMPACT:<br><br>MET 1:14:05<br><br>LAT: 36.723S<br><br>LONG: 158.957W | 51.6 (25) DIRECT INSERTION<br><br>POST OMS-2: 124.9X84.8 NM<br><br>DEORBIT: HA 190.0 NM HP 22.5 NM<br><br>ENTRY VELOCITY: 25859 FPS<br><br>ENTRY RANGE: 4402 NM |  | 01-32 (3)<br><br>CARGO: 38915 LBS<br><br>PAYLOAD CHARGEABLE: 30762 LBS<br><br>DEPLOYED: 29442 LBS<br><br>NON-DEPLOYED: 1132 LBS<br><br>MIDDECK: 188 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS:<br><br>DEPLOYED: 1423027 LBS<br><br>NON-DEPLOYED: 1601668 LBS<br><br>CARGO TOTAL: 3901248 LBS<br><br>PERFORMANCE MARGINS (LBS): FPR: 2651 FUEL BIAS: 1063 FINAL TDDP: 2109 RECON: 5128<br><br>PAYLOADS:<br><br>PLB: ISS-1JA (JAXA LOGISTICS MODULE)<br><br>MIDDECK: ISS-1JA<br><br>5 CRYO TANK SETS<br><br>RMS (79)<br><br>ODS OBSS SSPTS | <b>BRIEF MISSION SUMMARY:</b> STS-123/1JA (25th ISS mission) delivered the first pressurized component of the Japanese Kibo Laboratory to ISS, delivered a Canadian robotic device called Dextre, and provided five spacewalks. Endeavour's 16-day flight was the longest shuttle mission to the ISS. The Japanese Experiment Logistics Module Pressurized Section (ELMPS or JLP), the smaller of two pressurized modules of Kibo, was attached temporarily to a docking port on the space-facing side of Harmony. Kibo, which means "hope," is the major Japanese (JAXA) contribution to the Station, and will increase its research capability in a variety of disciplines. The robot Dextre is designed somewhat like the human form with a torso, a head area (camera), and arm appendages. It rides on the SSRMS as a "dexterous tool for ORU changeout without requiring a space walk." This mission included representation of all five Station partner interests - the U.S., Japan, Canada, Russia, and the European Space Agency (ESA).<br><br>KSC W/D: OPF: 159, VAB HB-1: 7, PAD A: 23 = 189 Total Work Days (+ 14 holidays @ OPF)<br><br><b>LAUNCH POSTPONEMENTS:</b><br>- Added STS-123 to FDRD - launch date of NET 12/08/07 on 11/14/06<br>- Postponed to 02/14/08 on 04/16/07. Slip due to STS-117 rollback<br>- Postponed to 03/11/08 on 01/28/08. Slip due to ECO sensor problems experienced during December launch attempt of STS-122<br><br><b>LAUNCH SCRUBS:</b> None<br><br><b>LAUNCH WINDOW:</b><br>Total launch window was 9 minutes 44 seconds with window open at 071:06:23:20Z and close at 071:06:33:04Z. Preferred Launch Time was 071:06:28:14Z (In-Plane Time) for a launch window of 4m54s.<br><br>Chief Astronaut Steve Lindsey flying the Shuttle Training Aircraft said, "It's a really nice night out here." PAO: "Florida's east coast is about to get an early sunrise!"<br><br><b>LAUNCH DELAYS:</b> None. Launch occurred on time at 2:28 a.m. EDT, Tuesday, March 11, 2008. An eclipse of the GOES-East weather satellite prevented using any satellite imagery in the hour prior to launch. Fortunately, the low clouds remained well behaved as skies were cloudy but above the range safety and Return to Launch Site (RTLS) cloud ceiling limits.<br><br>Continued... |   |
| SEQ FLT #122   | OMS PODS: LPO3-32 RPO4-28 FRC5-21 |  |  |  |   |  |   |  |   |   |   |
| KSC-122  |                                   |  |  |  |   |  |   |  |   |   |   |
| PAD 39A-45   |                                   |  |  |  |   |  |   |  |   |   |   |
| MLP-3  |                                   |  |  |  |   |  |   |  |   |   |   |
| 25TH SHUTTLE FLIGHT TO ISS   |                                   |  |  |  |   |  |   |  |   |   |   |
|    |                                   |  |  |  |   |  |   |  |   |   |   |
|   |                                   |  |  |  |   |  |   |  |   |   |   |
|  |                                   |  |  |  |   |  |   |  |   |   |   |
|  |                                   |  |  |  |   |  |   |  |   |   |   |



STS123-S-009 (11 March 2008) ---  
Overcast clouds at 6500 ft provided a spectacular night image as the clouds glowed from the Shuttle's exhaust.







# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                         | ORBITER | CREW (6+1 UP/6+1 DN)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N.                          | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP   |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---------------------------------|---------|--|---|--|--|------------------------|--|--|-----|---|---|
| STS-123/ISS 1JA<br>Continued... |         | Continued...<br><br>SS EVA 119<br>DOCKED QUEST EVA 42<br>EMU/TETHERED EVA 112<br>SCHEDULED EVA 110<br>DURATION 6:47<br><br>SS EVA 120<br>DOCKED QUEST EVA 43<br>EMU/TETHERED EVA 113<br>SCHEDULED EVA 111<br>DURATION 6:24<br><br>SS EVA 121<br>DOCKED QUEST EVA 44<br>EMU/TETHERED EVA 114<br>SCHEDULED EVA 112<br>DURATION 6:02<br><br>MCC WHITE FCR (52)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>ASC - B. C. Lunney<br>LD/O1 - M. P. Moses<br>O2 - R. E. LaBrode<br>PLNG - M. R. Abbott<br>ENT - R. S. Jones<br>MOD - P. L. Engelauf<br>Team 4 - R. S. Jones/<br>A. J. Ceccacci<br><br>ISS:<br>LD/O2 - D. J. Weigel<br>O1 - K. L. Alibaruho<br>O 3 - G. Kerrick<br>Team 4 - H. L. Rarick<br>IP FD - E. J. Nelson<br>(I/F w/CSA & JAXA)<br><br><u>CAPCOMS:</u><br><u>SHUTTLE:</u><br>A/E - J. P. Dutton<br>K. A. Ford (Wx)<br>LD/O1 - T. W. Virts<br>O2 - N. J. Patrick<br>PLNG - B. A. Drew<br>Team 4 - N/A<br><br>Continued... | Continued...<br><br><u>MECO CMD:</u><br>8:23.6 (P) 8:22.6(A)<br><br><u>VI:</u><br>25819 (P) 25817.6(A)<br><br><u>OMS-2:</u><br>38:15 (P) 38:30 (A)<br>97.4 FPS 96.1 FPS | Continued...<br><br><u>WINDS:</u><br>1.5T 1.3L KTS<br><u>OFFICIAL:</u><br>01002P03 KTS<br>2H 2R KTS<br><br><u>DENS ALT:</u> -336 FT<br><br><u>FLT DURATION:</u><br>15:18:10:52<br><br><u>S/T:</u><br>1153:00:57:10<br><br><u>OV-105:</u><br>235:02:18:33<br><br><u>DISTANCE:</u><br>6,577,857 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>467,923,507 sm |  |                        | ISS016-E-032598 (12 March 2008) --- The Canadian-built Dextre robotic system and the Japanese Kibo laboratory (JLP) are visible in Endeavour's cargo bay on approach to ISS. |  |     | Continued...<br><br><u>TAL WEATHER:</u><br>Weather at the TAL sites was tricky as showers were monitored near Zaragoza, Spain and Istres, France during the launch countdown. Post cold front low level wind flow from the northwest brought showers to the windward sides of the Pyrenees and central French mountains. These showers dissipated as they crossed the high terrain. TAL weather was GO.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: 1) PE Operational High Q WIN/MAR, 2) OMS Assist, 3) A 52 nm MECO, and 4) Del Psi<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>Deorbit burn was planned for 086:21:58:14Z. Due to low clouds moving in at KSC, the deorbit burn was delayed to second opportunity at 086:23:33:13.9Z. Landing occurred at 087:00:39:06Z, Wednesday, 03/26/08, at 8:39:06 PM EDT.<br><br><u>FIRSTS/LASTS:</u> <ul style="list-style-type: none"><li>- First 16-day Space Station Assembly Mission, 12 days docked. (Longest mission is STS-67 - Spacelab, 16D 21H 47M 35S.)</li><li>- Tied the current mission record of five spacewalks held by the HST Servicing Missions (STS-61, STS-82, and STS-109). Most EVA's docked to ISS.</li><li>- A redesign to RSRM Nozzle Joints 2 and 5, the latter with an additional bolt enhancement, follows up the new Nozzle-to-Case J-leg Joint insulation configuration that debuted on STS-122's motors.</li><li>- First flight of a lighting system derived from an off-the-shelf flash (Nikon SB800) was added to a digital camera (in orbiter umbilical well) to capture photos of ET after separation for about 130 ft away.</li><li>- This is the last modified tank (before Columbia) and the next will be a tank built with all mods done in line.</li><li>- First on-orbit test of orbiter tile repair technique.</li><li>- First time the OBSS was left on the Station so that the next flight can deliver the large JAXA Kibo module.</li><li>- This mission marks a significant milestone with the inauguration of the JAXA IP support to real-time operations, adding them to the fold with ESA, CSA, and Russia. "We have reached a new pinnacle in the 'international' part of the Space Station operations."</li><li>- Spacelab Logistics Pallet (SLP) used by Dextre made its fourth and final flight to space, "concluding a long history that can be traced back before the first shuttle left the launch pad." - PAO.</li><li>- First flight with John Shannon as Shuttle Program Manager.</li></ul> NOTE: The unmanned cargo ship Jules Verne, the ESA's first Automated Transfer Vehicle (ATV), launched toward ISS on March 7. It was parked well away from ISS at a safe distance until Endeavour's departure.<br><br>Continued... |   |
|                                 |         |  |   |  |  |                        |   |  |     | ISS016-E-033684-- Crews: STS-123 (green shirts) & ISS Exp 16 (blue shirts), ISS CDR Peggy Whitson (second right, rear), Yuri Malenchenko/FSA FE (left, front), and Garrett Reisman/FE (left rear). Also in green shirt is Leopold Eyharts/ESA (right rear), former Exp16 FE, who has moved over to the STS-123 crew. Leaving ISS with Eyharts are the Endeavour crew CDR Dominic Gorie (second left, rear), PLT Gregory H. Johnson (behind Malenchenko), Takao Doi/JAXA MS (right front), Rick Linnehan/MS (behind Doi); Mike Foreman/MS (second right, center row); Robert L. Behnken/MS (far left, center row).   |   |






## SPACE SHUTTLE MISSIONS SUMMARY






| FLT NO.  | ORBITER | CREW (6+1 UP/6+1 DN)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME,<br><br>LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE ENG. S.N. | SRB RSRM<br><br>AND ET | ORBIT<br><br>INC HA/HP | FSW | PAYLOAD WEIGHTS,<br><br>PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--|---------|---|--|---|---|------------------------|------------------------|-----|---|---|
| STS-123/ ISS 1JA<br>Continued...   |         | Continued...<br><br>ISS:<br>O1 - Z. Jones<br>LD/O2 - S. K. Robinson<br>O3 - M. T. Vande Hei<br>Team 4 - R. C. Dempsey |  |   |   |                        |                        |     |   | Continued...<br><br><u>NIGHT LAUNCH #30:</u> Shannon: "We are launching in the dark."<br><br><u>NIGHT LANDING KSC #16:</u> (#22 in Shuttle history)<br><br><u>RENDEZVOUS #70:</u> Rendezvous and dock with ISS<br><br><u>EVENTS:</u><br>- OMS2 Ignition at 071:07:06:44.0Z resulted in a 124.9 by 84.8 nm orbit.<br>- SRMS OBSS/LDRI survey of noscap and port and starboard wing RCC (WLE's) was completed.<br>- T1 maneuver at 073:00:42:21.9Z resulted in a 186.3 by 180.6 nm orbit.<br>- R-Bar Pitch Maneuver was performed. No issues<br>- Docking contact occurred at 073:03:46:54Z.<br>- Hard Dock occurred at 073:04:02:11Z<br>- ISS Hatch opened at 073:05:36:00Z, 12:36 AM CDT, Thursday, March 13, 2008, ISS crew welcoming<br>- IELK Seat Liner Transfer at 073:07:50Z (2:50 AM CDT, March 13, 2008). At that time Leopold Eyharts/ESA became a member of STS-123 and Garrett Reisman joined the ISS Expedition 16/17 as Flight Engineer.<br>- The first transfer item after hatch opening was swapping Garrett Reisman/MS for Leopold Eyharts (ESA)/Expedition 16 FE. The transfer was official when the form-fitting Soyuz seatliners were swapped. Eyharts spent 33 days as a member of ISS Expedition 16. With the on-time landing of March 26, Eyharts spent a total of 48 days in space.<br>- FD4/5: EVA 1: EV1 & EV4: JLP prepped for unberthing, shuttle robot arm grappled JLP, Orbital Replacement Unit (ORU) and Tool Changeout Mechanism installed on the Canadian Special Purpose Dexterous Manipulator (SPDM or Dextre) arm 2 and arm 1, shuttle arm unberthed JLP, and shuttle arm installed JLP onto Harmony zenith port (temporary location until Kibo delivery on STS-124). Unable to provide keep-alive power to SPDM (later determined to be flawed cable in pallet). EVA 1 duration 7:01<br>- FD6: While Expedition 16 and STS-123 crewmembers brought the Kibo logistics module to life, Dextre's power supply unit was brought to life via the SSRMS.<br>- FD6: EVA 2: EV1 & EV3: EVA ran long due to problems with the SPDM Arm Expandable Diameter Fasteners (EDF's) not releasing per procedure. Crew ended up using a pry bar. Time didn't permit removing some of the SPDM blankets. EV3 experienced RTV delamination. Per Rule (1JA_C2-105), EMU OVERGLOVE EXCEPTIONS, crew continued the SPDM assembly task without donning overgloves due to the thermal constraints on SPDM. EV3 donned overgloves once the thermal critical tasks were complete. ISS multimeter was repaired and would later be swapped with shuttle multimeter prior to hatch closure. Installed the Node 2/JLP vestibule barrier assembly. EVA 2 duration 7:09<br><br>Continued... |
|                                        |         |   |  |   |   |                        |                        |     |   |   |
| S123-E-006403 --- Linnehan & Foreman assemble the stick-figure Dextre including attaching its two arms during EVA 2.   |         |   |  | S123-E-007088 (18 March 2008) --- Canada's two armed robot, Dextre, is shown in the grasp of the station's robotic Canadarm2.   |   |                        |                        |     |   |   |
|                                       |         |   |  |    |   |                        |                        |     |   |   |
| S123-E-006089 --- Reisman, Exp 16 & Linnehan (out-of frame) prepare tool change out mechanisms on Dextre during EVA 1. |         |   |  | S123-E-006729 --- Linnehan (right) & Behnken install a spare-parts platform and tool-handling assembly for Dextre during EVA 3. |   |                        |                        |     |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                          | ORBITER  | CREW (6+1 UP/6+1 DN) | LAUNCH SITE, LIFTOFF TIME,  | LANDING SITE/ RUNWAY, CROSSRANGE   | SXME-TL NOM-ABORT EMERG    | SRB RSRM   | ORBIT |       | FSW | PAYLOAD WEIGHTS,      | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|----------------------------------|--|----------------------|---|--|----------------------------|--|-------|-------|-----|-----------------------|---|
|                                  |  | TITLE, NAMES & EVA'S | LANDING SITES, ABORT TIMES  | LANDING TIMES FLT DURATION, WINDS  | THROTTLE PROFILE ENG. S.N. | AND ET   | INC   | HA/HP |     | PAYLOADS/ EXPERIMENTS |   |
| STS-123/ ISS 1JA<br>Continued... |                         |                      |   |  |                            | Flight Directors Bryan Lunney & Norm Knight in JSC MCC   |       |       |     |                       | Continued...  |
|                                  | S123-E-009262 (24 March 2008) --- The ISS latest configuration is viewed from Endeavour post-separation. |                      |   |  |                            | <p><b>SIGNIFICANT ANOMALIES:</b></p> <p>Orbiter:</p> <ul style="list-style-type: none"><li>- Sensor Unit S/N 1150 on the port wing had excessive triggers (quantity 4452) during the first hour of MMOD monitoring for Late Inspection.</li><li>- Integrated Sensor Inspection System Sensor Pack 1 Pan Tilt Unit 10 degrees offset</li><li>- DCS OI1 card 1 failure</li><li>- FES shutdown on Primary A Controller</li><li>- GG Chamber pressure indicated a shift upward</li><li>- APU 1 fuel tank pressure decay</li><li>- LH OMS Pod mid surface temperature</li><li>- Sensor Unit 1150 (Ref Des: 65V08A01) on the port wing</li><li>- APU 3 seal cavity drain line pressures indicate slow decay.</li><li>- Body Flap tile damage</li><li>- Aft arrowhead damage</li><li>- STBD FWD RAD Retract Flexhose did not fully retract into RRSR (ref SPC# 205181853).</li><li>- APU 1 Gas Generator Chamber Pressure Transducer shift</li><li>- Cabin Temp Controller 1 noisy</li><li>- MPS E-3 LOX Inlet pressure showed a shift of 30 psi at Liftoff.</li><li>- MADS PCM MSRMNT gradually and abruptly moved to OSH throughout the MADS and MMU1/SSR1 recording phase.</li><li>- Lost OMS POD (RH OMS024) putty repair</li><li>- Damage to the V070-391044-174 (BRI-18) tile</li><li>- Damage to the V070-191101-043 (BRI-18) tile</li></ul> <p>SRB:</p> <ul style="list-style-type: none"><li>- Loss of data from SRB RH ET Observation Camera during Ascent</li></ul> <p>RSRM: None</p> <p>SSME: None</p> <p>ET: None</p> <p>MOD:</p> <ul style="list-style-type: none"><li>- White-VTS-Servers hung</li></ul> <p>Integration:</p> <ul style="list-style-type: none"><li>- Unexpected debris/expected debris exceeding mass allowables prior to pad clearance (Liftoff debris)</li><li>- Stub Tile damage during SSME ignition</li><li>- Tile chips on orbiter stingers during SSME ignition</li></ul> |       |       |     |                       | <p>- FD8: RTV Loss in EVA Gloves: EV3's gloves were NO-GO for subsequent EVA's. First spare set used on EVA 4.</p> <p>- FD8: EVA3: EV1 &amp; EV2: Finished assembly of Dextre, including installation of tool holder assembly and a Camera Light Pan Tilt Assembly (CLPA) which serves as Dextre's eyes. Also, the Spacelab Logistics Pallet used for assembly was prepared for return to shuttle cargo bay. Attempted to install MISSE-6 experiment (unsuccessful - moved to EVA5). EVA 3 duration 6:53</p> <p>- FD10: Japanese Prime Minister called to congratulate the crew.</p> <p>- FD10: During press interview, asked to describe the fast-growing Space Station, Reisman said the crew was struck by the view during final approach and similarities with the famous Space Station scene in the movie "2001: A Space Odyssey" by Stanley Kubrick and Arthur C. Clarke. Clarke died during this mission on 3/19/08 at the age of 90. Clarke in "First on the Moon" stated, "The inspirational value of the space program is probably of far greater importance to education than any input of dollars... a whole generation is growing up which has been attracted to the hard disciplines of science and engineering by the romance of space."</p> <p>- FD11: EVA4: EV2 &amp; EV3: Tasks were Remote Power Control Module removal and replacement, and the Tile Repair Ablator Dispenser (T-RAD) detailed test objective worksite setup and demonstration. The demonstration was considered a "huge" success, but needs results from post-landing detailed analysis. EVA 4 duration 6:24</p> <p>- FD13: EVA 5: EV2 &amp; EV3: Primary tasks completed were positioning of OBSS to temporary home on ISS truss, installation of MISSE-6 experiment, and inspection of SARJ. EVA 5 duration 6:02</p> <p>- FD14: Conducted Rigidizable Inflatable Gas Experiment (RIGEX) funded by the Air Force. RIGEX was designed to test how well ground models and computer simulations predict what happens to the inflated structures in weightlessness. Once rigid, the sample tubes aboard Endeavour were blasted with vibrations to test their structural integrity. The experiment was returned to Earth aboard the shuttle for further scientific analysis.</p> <p>- Transfers:</p> <ul style="list-style-type: none"><li>• Hardware transferred to Station (outside and inside): 25839 lbs</li><li>• Hardware transferred to Station (outside): 23776 lbs</li><li>• Hardware transferred to Station (inside): 1432 lbs</li><li>• Japanese pressurized logistics module: 18377 lbs</li><li>• Dextre - Special Purpose Dexterous Manipulator: 3431 lbs</li><li>• Middeck items returned from ISS aboard Endeavour: 1565 lbs</li><li>• Water transferred to Station: 608 lbs</li><li>• Oxygen transferred to Station: N/A</li><li>• Nitrogen transferred to Station: 23 lbs</li></ul> <p>- Undocked at 085:00:25:00Z followed by a flyaround (1/2 lap). (Undocking was delayed 29 minutes due to two ISS Beta Gimbal Assembly (BGA) latch aborts.)</p> <p>- Communications blackout time during Entry: 6m</p> <p><b>NOTE:</b> Currently, 590826 lbs mass in space of the ISS and ISS assembly 70% complete.</p> |
|                                  |                        |                      | JSC2008-E-025177 --- Flight Controller Bill Foster in JSC MCC during launch countdown activities. |  |                            |  |       |       |     |                       | JSC2008-E-025187 --- Astronaut George Zamka, Spacecraft Communicator (CAPCOM), monitors data during launch countdown.   |


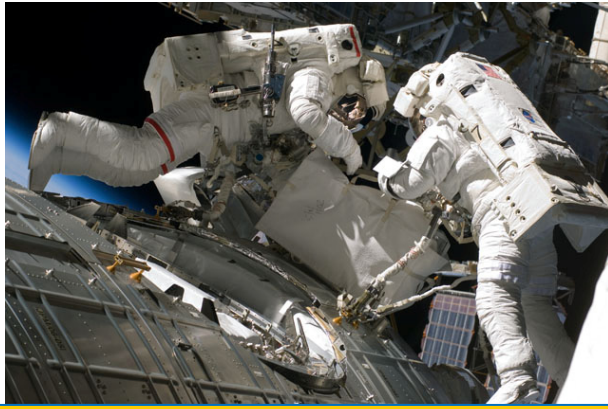
# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER   | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET  | ORBIT  |   | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|---|--|---|---|--|--|---|--|--|---|
| STS-124/ISS 1J<br><br>SEQ FLT# 123<br>KSC-123<br>PAD 39A-46<br>MLP-3<br><br>26TH SHUTTLE FLIGHT TO ISS | OV-103 (Flight 35)<br>DISCOVERY<br><br>OMS PODS:<br>LPO1-38<br>RPO3-36<br>FRC3-35 | CDR:<br>Mark E. Kelly<br>(Flt 3 - STS-108, STS-121)<br>P763/R271/V181/M237<br><br>PLT:<br>Kenneth T. Ham<br>P764/R326/M282<br><br>MS 1/Robotics:<br>Karen L. Nyberg<br>P765/R327/F45<br><br>MS 2/EV2:<br>Ronald J. Garan<br>P766/R328/M283<br><br>MS 3/EV1:<br>Michael E. Fossum<br>(Flt 2 - STS-121)<br>P767/R296/V196/M259<br><br>MS 4/Robotics:<br>Akihiko Hoshide<br>(Japan)<br>P768/R329/M284<br><br>MS 5 UP/Stay as EXP 17/18<br>FLT ENG:<br>Gregory E. Chamitoff<br>P769/R330/M285<br><br>MS 5 DN/EXP 16/17 FLT ENG:<br>Garrett E. Reisman<br>(Up on STS-123, stay ISS)<br>P770/R325/M281<br><br>SPECIAL EDUCATOR<br>"Buzz" Lightyear<br>(UP/EXP 18)<br>See "Firsts" | KSC 39A<br>15:21:02:12Z<br>5:02:12 PM EDT (P)<br>5:02:12 PM EDT (A)<br>Saturday (7)<br>05/31/08 (7)<br><br>LAUNCH WINDOW:<br>6M 47S (PLT IN-PLANE)<br><br>EOM PLS: KSC<br>TAL: MRN<br>TAL WX: FMI<br><br>SELECTED:<br>RTLS: KSC 15 N/N<br>TAL: MRN 20 N/N<br>(ZZA NO-GO)<br>AOA: KSC 15 N/N<br>1ST DAY PLS: EDT<br>22 N/N<br><br>TDEL:<br>0:00(P) -0.508(A)<br><br>MAX Q NAV:<br>715.16(P) 701.98(A)<br><br>SRB STG:<br>2:03:36(P) 2:02:56(A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA):<br>2:48(P) 2:47(A)<br><br>NEG RETURN:<br>3:48 3:55<br><br>PTA (U/S 159 FPS):<br>5:19 5:23<br><br>SE TAL (FMI 104):<br>6:08 6:13<br><br>PTM (U/S 180 FPS):<br>6:18 6:29<br><br>SE PRESS 104<br>7:01 7:07<br><br>MECO CMD:<br>8:24 8:26.3 | KSC 15 (KSC 69)<br>16:15:15:18Z<br>11:15:18 AM EDT<br>Saturday (22)<br>06/14/08 (8)<br><br>DEORBIT BURN:<br>16:14:10:12Z<br><br>X RANGE: 270.2 NM<br><br>ORBIT DIR: A/L 39<br><br>AIM PT: NOMINAL<br><br>MLGTD: 2100 FT<br>16:15:15:17Z<br>VEL: 209 KGS<br>208 KEAS<br>HDOT: -2.1 FPS<br><br>TD NORM 195:<br>3172 FT<br><br>DRAG CHUTE DEPLOY:<br>194 KEAS<br>16:15:15:20Z<br><br>NLGTD: 5601 FT<br>16:15:15:28Z<br>VEL: 155 KGS<br>148 KEAS<br>HDOT: -7.0 FPS<br><br>BRK INIT: 77 KGS<br><br>DRAG CHUTE JETTISON:<br>54 KGS<br>16:15:15:59Z<br><br>BRK DECEL FPS <sup>2</sup> :<br>AVE 4.8 PK 6.3<br><br>WHEELS STOP:<br>16:15:16:19Z<br>11421 FT<br><br>ROLLOUT:<br>9321 FT<br>1:02 M:S | 104/104/109%<br><br>PREDICTED:<br>100/104.5/<br>104.5/72<br>104.5<br><br>ACTUAL:<br>100/104.5/<br>104.5/72<br>104.5<br><br>1 = 2051 (7)<br>2 = 2048 (8)<br>3 = 2058 (2)<br><br>M 3 EOM:<br><br>WEIGHT:<br>203604.5 LBS<br><br>X CG:<br>1088.03 IN<br><br>LANDING:<br><br>WEIGHT:<br>203558.5 LBS<br><br>X CG:<br>1090.00 IN | BI-134<br><br>RSRM 102<br><br>ET-128<br><br>SLWT 31<br><br>ET IMPACT<br><br>MET 1:14:18<br><br>LAT: 36.362S<br><br>LONG: 158.449W<br><br>X CG:<br>1088.03 IN<br><br>LANDING:<br><br>WEIGHT:<br>203558.5 LBS<br><br>X CG:<br>1090.00 IN | 51.6 (26)<br><br>DIRECT INSERTION<br><br>POST OMS-2:<br>170.3x125.0 NM<br><br>DEORBIT:<br>HA 190.6 NM<br>HP 23.3 NM<br><br>ENTRY VELOCITY:<br>25866 FPS<br><br>ENTRY RANGE:<br>4396 NM | OI-32 (4)<br><br>CARGO:<br>41997 LBS<br><br>PAYLOAD CHARGEABLE:<br>33969 LBS<br><br>DEPLOYED:<br>33890 LBS<br><br>NON-DEPLOYED:<br>0 LBS<br><br>MIDDECK:<br>79 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS:<br>DEPLOYED:<br>1456917 LBS<br><br>NON-DEPLOYED:<br>1601747 LBS<br><br>CARGO TOTAL:<br>3943245 LBS<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 2651<br>FUEL BIAS: 1063<br>FINAL TDDP: 1308<br>RECON: 2513<br><br>PAYLOADS:<br>PLB:<br>ISS 1J<br><br>MIDDECK:<br>ISS 1J<br>MAUAI<br><br>5 CRYO TK SETS<br><br>SRMS (80)<br>ODS, OBSS (Return Only)<br>SSPTS | <b>BRIEF MISSION SUMMARY: STS-124/1J (26<sup>th</sup> ISS mission) delivered the second and main segment of the Japanese (JAXA) Station Kibo (Hope) Laboratory. This segment known as the Japanese Pressurized Module (JPM) is the ISS's largest laboratory measuring 14.4 feet in diameter and 36.7 feet long. The Kibo complex also includes: An airlock and two robotic arms also delivered on this flight; the Japanese Experiment Logistics Module Pressurized Section (launched on STS-123); and an exterior platform for experiments exposed to space, scheduled for delivery on STS-127. The STS-124 mission is the first in which the JAXA Flight Control Team activated and controlled a module from Kibo Mission Control in Tsukuba, Japan. Also, as the STS-124 launch countdown got underway, a special Russian pump was added to Discovery's manifest to fix "a balky toilet" on the ISS.</b><br><br>KSC W/D: OPF: 157, VAB HB-1: 7, PAD A: 29 = 193 Total Work Days (+ 13 Holidays @ OPF)<br><br><b>LAUNCH POSTPONEMENTS:</b><br>- Added STS-124 to FDRD - launch date of 02/28/08 on 02/20/07.<br>- Ppd. to 04/24/08 on 04/16/07. Slip due to STS-117 rollback.<br>- Ppd. to 05/25/08 on 03/07/08. Slip due to ET delivery delay and Beta Angle restriction.<br>- Ppd. to 05/31/08 on 04/03/08. Slip due to adverse weather conditions affected on dock delivery date of ET-128.<br><br><b>LAUNCH SCRUBS:</b> None<br><br><b>LAUNCH WINDOW:</b><br>Total launch window was 7 minutes 45 seconds with window open at 15:21:01:14Z and close at 15:21:08:59Z. Preferred Launch Time was 15:21:02:12Z (In-Plane Time) for a launch window of 6m47s.<br><br><b>LAUNCH DELAYS:</b> None.<br>Launch occurred on time at 15:21:02:12Z, 5:02:12 p.m. EDT, Saturday, May 31, 2008. On launch day, the sea breeze pushed across KSC with showers just west of the launch pad several hours before launch time. However, the sea breeze had pushed west of KSC by early afternoon with near ideal conditions for launch. Thunderstorms were occurring over central Florida but were well outside the 20 nautical mile thunderstorm flight rule limit. "Nice day to send 'Hope' to the ISS" – PAO. Cain: "If you watched today, you saw a flawless countdown."<br><br>Continued... |  |   |
|                        |   |   |  |   |   |  |  |   |  |  |   |
|                       |   |   |  |   |   |  |  |   |  |  |   |
|                      |   |   |  |   |   |  |  |   |  |  |   |
|  |   |    |  |   |   |  |  |   |  |  |   |
|  |   | Continued...  | Continued...   | Continued...  |   |  |  |   |  |  |   |





# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                            | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC<br>HA/HP   |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|------------------------------------|---------|--|---|--|---|--------------------------|---|--|-----|--|--|
| STS-124/<br>ISS 1J<br>Continued... |         | Continued...<br><br>SS EVA 122<br>DOCKED QUEST EVA 45<br>EMU/TETHERED EVA 115<br>SCHEDULED EVA 113<br>DURATION 6:48<br><br>SS EVA 123<br>DOCKED QUEST EVA 46<br>EMU/TETHERED EVA 116<br>SCHEDULED EVA 114<br>DURATION 7:11<br><br>SS EVA 124<br>DOCKED QUEST EVA 47<br>EMU/TETHERED EVA 117<br>SCHEDULED EVA 115<br>DURATION 6:33<br><br>MCC WHITE FCR (53)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>ASC - N. D. Knight<br>LD/O1 - M. R. Abbott<br>O2 - M. L. Sarafin<br>PLNG - P. F. Dye/<br>A. J. Ceccacci<br>ENT - R. S. Jones<br>MOD - J. A. Mccullough<br>Team 4 - R. E. LaBrode<br><br>ISS:<br>LD/O2 - A. P. Hasbrook<br>O1 - R. C. Dempsey<br>O3 - E. J. Nelson<br>Team 4 - B. T. Smith<br>IP FD - H. E. Ridings<br>(I/F w/JAXA)<br><br>Continued... | Continued...<br><br>VI:<br>25819                      25820<br><br>OMS-2:<br>37:20                      37:21<br>250.7 FPS 249.1FPS | Continued...<br><br>WINDS:<br>0 KT 5 L KTS<br>OFFICIAL:<br>07007P12 KTS<br>1H 12L KTS<br><br><u>DENS ALT:</u><br>1748 FT<br><br><u>FLT DURATION:</u><br>13:18:13:06<br><br><u>S/I:</u> 1166:19:10:16<br><br><u>OV-103:</u><br>305:08:10:09<br><br><u>DISTANCE:</u><br>5,735,643 sm<br><br><u>TOTAL SHUTTLE<br/>DISTANCE:</u><br>473,659,150 sm | <br>S124-E-005921 --- In the grasp of ISS robotic Canadarm2, the Kibo Japanese Pressurized Module (JPM) is moved from Discovery's payload bay to the port side of the Harmony node.                   |                          | Continued...<br><br><u>TAL WEATHER:</u><br>The TAL weather conditions were rather challenging. An upper low had been spinning over Spain for several days, drifting slowly to the northwest. Timing differences in the models made forecasting where precipitation would develop difficult. Initially on L-2 day, NO-GO forecasts were issued for Moron and Zaragoza, Spain with a GO forecast for Istres, France. Shuttle launches require only one of the three TAL sites have GO weather. As the upper low began to finally move to the northwest, forecasts were updated to GO for Moron, but a NO-GO for Istres. On launch day, Moron weather remained favorable and conditions at Istres improved and were GO. Zaragoza was observed NO-GO at TAL landing time.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: 1) PE Operational High Q TRN/JUN, 2) OMS Assist, 3) A 52 nautical mile MECO, and 4) Del Psi.<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u> None<br><br><u>FIRSTS/LASTS:</u><br>- First flight of an ET built from scratch with all of the safety modifications stemming from the 2003 Columbia accident. "This essentially is the completed return-to-flight tank," Shannon.<br>- First docking of Shuttle while ATV also docked to ISS.<br>- First OBSS transfer from ISS to Orbiter.<br>- First Post-Undock Inspection (Orbiter heat shield) will be the full "FD2 Inspection" done on previous missions.<br>- First flight of Modified EMU gloves: includes addition of Turtleskin™ patches to thumb and index finger – to provide increased protection against cuts.<br>- A first: NASA and Disney joined forces for education. "Buzz Lightyear," a 12-inch tall action doll, based on the cartoon character from the Pixar Studios Toy Store animated movies was delivered to the ISS for a 6-month stay. While on ISS, Lightyear will demonstrate zero gravity to elementary school children.<br><br><u>NIGHT LAUNCH:</u> N/A<br><br><u>RENDEZVOUS:</u> #71 - Rendezvous and dock with ISS<br><br>Continued... |  |     |  |  |
|                                    |         |  |   |  | <br>S124-E-006361 --- Fossum & Garan outfitted the outside of the JPM, installing covers and external television equipment and removing thermal covers and insulation on the JAXA RMS and top hatch. |                          |   |  |     |  |  |

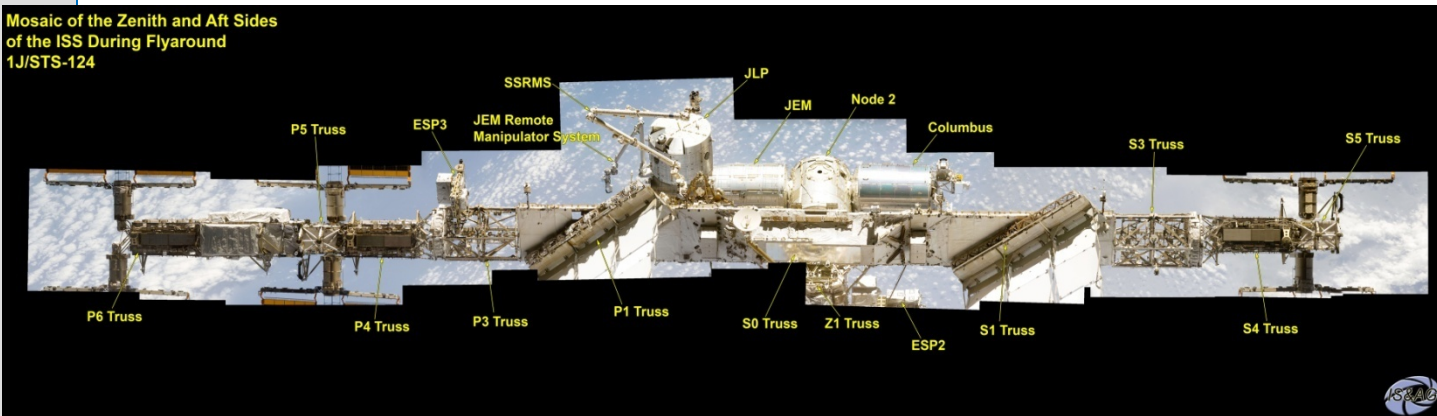


# SPACE SHUTTLE MISSIONS SUMMARY

[illegible]




# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-196 - STS-124/1J




| FLT NO.   | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL<br>NOM-ABORT<br>EMERG | SRB<br>RSRM<br>AND<br>ET  | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|----------------------------------|--|--|-------------------------------|---|-----------------------|--|-----|---|--|
| STS-124/<br>ISS 1J<br>Continued...  |         |                                  |  |  |                               |   |                       |  |     |   | Continued...   |
| <div>Mosaic of the Zenith and Aft Sides of the ISS During Flyaround 1J/STS-124</div>   |         |                                  |  |  |                               |   |                       |  |     |   |  |
|    |         |                                  |    |  |                               | <div>SIGNIFICANT ANOMALIES:</div> <div>Orbiter:</div> <ul style="list-style-type: none"><li>- TCS Dropouts during Rendezvous</li><li>- Engine # 2 Dome Heat C/P Tile Damage</li><li>- Imagery Showed F3D (V070-421558-024) and F44 (V070-421558-025) Tyvek Rain Covers Released Late</li><li>- IMU 1 Z Gyro excessive drift</li><li>- The Left Hand ET Door BRI-18 Tile V070-395055-255</li><li>- Rudder Speed Brake Thermal Tab found dislodged and floating</li><li>- A buildup of ceramic adhesive identified under the Thermal Barrier</li><li>- Closed 2 Indication failed to Transfer On when door was closed</li><li>- Crew reported difficulty latching the External Airlock Upper Hatch prior to Undocking</li></ul> <div>KSC:</div> <ul style="list-style-type: none"><li>- STS-124 Pad debris items</li></ul> <div>SRB:</div> <ul style="list-style-type: none"><li>- STS-124/BI-134rh Data Acquisition System failed to record video and obtained erroneous Accelerometer data</li></ul> <div>RSRM: None. SSME: None. MOD: None</div> <div>ET:</div> <ul style="list-style-type: none"><li>- STS-124/ET-128 Post-Launch Camera Film Review showed two foam losses (80971008428-510) on Xt 1129 LO2 Feedline Support Fitting Closeout</li></ul> <div>Integration:</div> <ul style="list-style-type: none"><li>- Unexpected Debris/Expected Debris Exceeding Mass Allowable prior to Pad clearance (Liftoff Debris)</li><li>- Late Tyvek partial cover releases</li><li>- Roll Moment during SRB Tail-off</li><li>- Liberated Refractory Brick, NE Flame Trench Wall Pad A</li><li>- ET TPS loss at ~Xt 1129, near LO2 Feedline Bracket</li></ul>   |                       |  |     |   |  |
| JSC2008-E-043220 --- John McCullough (left), chief of the Flight Director Office, part of the Mission Operations Directorate at JSC, and Bryan Lunney, Flight Director and a mission manager observe KSC launch from MCC. |         |                                  | STS124-S-072 --- A close look at Discovery post landing at KSC. From left: KSC Director Bill Parsons and Bill Gerstenmaier, NASA Associate Administrator for Space Operations. At right: JAXA Director of Program Management & Integration Yuichi Yamaura & VP Kaoru Mamiya. |  |                               | <ul style="list-style-type: none"><li>- FD9: EVA 3: Fossum &amp; Garan began the EVA 30 minutes ahead of schedule. The EVA was highlighted by Garan's dramatic robot ride some 80 feet over the top of the ISS to replace a 550 lb nitrogen tank on the starboard truss. The ride was dubbed the "windshield wiper maneuver" or as Mark Carreau (Houston Chronicle) headlined it: "Wild robot-arm ride caps workday at Space Station." Fossum returned to the port SARJ (inspected on EVA 2) taking particulate matter from inside the joint, using a strip of tape that was returned to Earth for analysis. He also removed thermal insulation from the Kibo robotic arm's wrist and elbow cameras and launch locks from one of the Kibo windows and deployed debris shields on Kibo. Other tasks by the pair included: The repaired video camera retrieved on EVA 2 was re-installed and several extra tasks (installation of thermal cover on Harmony, relocation of foot restraint aid, and removal of SARJ launch lock) were conducted. EVA 3 duration 6:33.</li><li>- Transfers:<ul style="list-style-type: none"><li>• Hardware transferred to ISS (outside &amp; inside): 34,353 lbs</li><li>• Hardware transferred to ISS (inside): 1,787 lbs</li><li>• Hardware transferred to shuttle (outside – OBSS): 536 lbs</li><li>• Hardware/supplies transferred from ISS (inside): 1,807 lbs</li><li>• H2O delivered to ISS: 569 lbs</li><li>• O2 used for the 3 EVA's: 92 lbs</li><li>• N2 transferred to ISS: 15 lbs</li></ul></li><li>- FD12: Undocked at 163:11:41:54Z followed by a fly-around (1/2 lap).</li><li>- Conducted the late inspection of the Shuttle's heat shield using the OBSS. No issues.</li><li>- FD14: Rudder/Speedbrake thermal spring tab was seen floating away from the vehicle during the FCS checkout. The function of the tab is to prevent a flow path for ascent heating and is not required for entry. The TPS was cleared for entry.</li><li>- [Post-flight, this issue was presented to 08/07/08 PRCB; decision was made to continue to fly as is. PRCB directed a new ascent thermal environmental assessment to consider flying without the tabs.]</li><li>- No communications blackout during Entry</li></ul> |                       |  |     |   |  |

## Page 2-197 - STS-126/ULF2



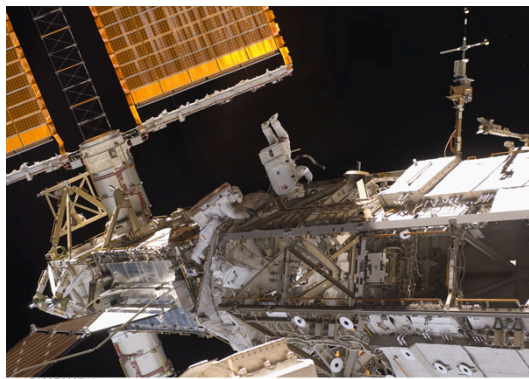
| FLT NO.   | ORBITER   | CREW<br>(6+1 UP/6+1 DN)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br><br>AND<br>ET  | INC   | HA/HP   | FSW          | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---|--|--|--|---|---|---|---|--------------|--|---|
| STS-126/<br>ISS- ULF2   | OV-105<br>(Flight 22)<br>ENDEAVOUR                | CDR:<br>Chris Ferguson<br>Flt 2 (STS-115)<br>P771/R300/V197/M179   | KSC 39A<br>320:00:55:39Z<br>7:55:39 PM EST (P)<br>7:55:39 PM EST (A)<br>Friday (26)<br>11/14/08 (15)   | EDT04 CONC<br>EDW 52 CONC 33<br>335:21:25:09Z<br>1:25:09 PM PST<br>Sunday (15)<br>11/30/08 (13)  | 104/104/109%<br><br><u>PREDICTED:</u><br>100/104.5/104.5/<br>72/104.5<br><br><u>ACTUAL:</u><br>100/104.5/104.5/<br>72/104.5   | BI-136<br><br>RSRM<br>104<br><br>ET-129<br><br>SLWT<br>32   | 51.6<br>(27)  | DIRECT<br>INSERTION<br><br>POST OMS-2:<br>125.7x 84.6NM | OI-33<br>(1) | CARGO:<br>39471 LBS<br><br><u>PAYLOAD<br/>CHARGEABLE:</u><br>32403 LBS<br><br><u>DEPLOYED:</u><br>30432 LBS<br><br><u>NON-DEPLOYED:</u><br>1760 LBS<br><br><u>MIDDECK:</u><br>211 LBS<br><br><u>SHUTTLE<br/>ACCUMULATED<br/>WEIGHTS:</u><br><u>DEPLOYED:</u><br>1487349 LBS<br><u>NON-DEPLOYED:</u><br>1603708 LBS<br><br><u>CARGO TOTAL:</u><br>3982716 LBS<br><br><u>PERFORMANCE<br/>MARGINS (LBS):</u><br>FPR: 2651<br>FUEL BIAS: 1063<br>FINAL TDDP: 1682<br>RECON: 2329<br><br><u>PAYLOADS:</u><br><u>PLB:</u><br>ISS-ULF2 (MPLM,<br>LMC),SSPL/PSSC<br><br><u>MIDDECK:</u><br>ISS-ULF2, MAUI<br>SEITE<br><br>5 CRYO TANK SETS<br><br>RMS (81) SRMS,<br>ODS, OBSS, SSPTS | <u><b>Brief Mission Summary:</b></u> "Extreme Home Improvements"<br>STS-126/ULF2 (27th ISS mission) outfitted the ISS to increase accommodations from a crew of three to six. Life support and habitability additions included: an advanced resistive exercise device, a second toilet, a galley, two sleep stations and an integrated water recycling system. The mission also included EVA's for lubricating the sluggish Solar Alpha Rotary Joints (SARJ) and installation of other external systems.<br><br>Endeavour was originally rolled to Launch Pad 39B as the Launch on Need (LON) vehicle in support of STS-125 HST servicing mission. Last minute complications with HST caused an indefinite delay for STS-125. Endeavour was rolled to Launch Complex 39A and prepared for the STS-126 November launch date. (Shuttles have only moved from one spaceport launch pad to another twice before in the program's history, in 1990 and 1993.)<br><br><u><b>KSC W/D</b></u><br>The Orbiter prep days are 162 workdays (W/D) + 3 holidays + 3 weather days in the OPF.<br>VAB ops = 7 W/D + 1 weather day<br>Pad B ops = 19 W/D + 15 contingency days<br>Pad A ops = 18 W/D + 5 contingency days<br>Total W/D = 206<br><br><u><b>LAUNCH POSTPONEMENTS</b></u><br>- Added STS-126 to FDRD - launch date of 09/18/08 on 08/15/07.<br>- Ppd. to 10/16/08 on 02/14/08. Slip due to ECO sensor problems experienced during December launch attempt of STS-122.<br>- Ppd. to 11/10/08 on 05/27/08. Slip due to delays in delivery of ET-127 & ET-129 for STS-125 & STS-400, respectively.<br>- Ppd. to 11/12/08 on 09/08/08. Slip due to Hurricane Faye impacts to HST payload readiness.<br>- Ppd. to 11/16/08 on 09/24/08. Slip due to STS-125 slip to from 10/10/08 to 10/14/08 caused by Hurricane Ike.<br>- Launch moved forward to 11/14/08 on 10/19/08. Move due to critical path adjustment. STS-126/ULF2 now "prime crew" as STS-125 postponed to NET Mid-Feb 2009 on 10/02/08.<br><br><u><b>LAUNCH SCRUBS:</b></u> None.<br><br>Continued... |
| SEQ<br>FLT # 124  | <u>OMS PODS:</u><br>LPO3-33<br>RPO4-29<br>FRC5-22 | <u>PLT</u><br>Eric Boe<br>P772/R331/M286<br><br><u>MS1</u><br>Donald Pettit<br>Flt 2 (STS-113 Up – Soyuz TMA-1 Dn)<br>P773/R289/V198/M253<br><br><u>MS2</u><br>Steve Bowen<br>P774/R332/M287<br><br><u>MS3</u><br>Heidemarie Stefanyshyn-Piper<br>Flt 2 (STS-115)<br>P775/R301/V199/F40<br><br><u>MS4</u><br>Shane Kimbrough<br>P776/R333/M288<br><br><u>MS5 UP Stay ISS<br/>EXP 18/FLT ENG</u><br>Sandra Magnus<br>Flt 2 (STS-112)<br>P777/R284/V200/F36<br><br><u>MS5 DN EXP 17/Flt ENG</u><br>Greg Chamitoff<br>(UP ON STS-124, stay ISS)<br>P778/R330/M285 | <u>LAUNCH WINDOW:</u><br>4M 39S (PLT in-plane)<br><br><u>EOM PLS:</u> KSC<br><u>TAL:</u> ZZA<br><u>TAL WX:</u> FMI<br><br><u>SELECTED:</u><br>RTLS: KSC15<br>CI/NOM<br><u>TAL:</u> ZZA30L N/N<br><u>AOA:</u> KSC15 CI/N<br><u>1<sup>ST</sup> DAY PLS:</u> EDT22<br>N/SFD<br><br>Continued... | <u>DEORBIT BURN:</u><br>335:20:19:29Z<br><br><u>XRANGE:</u> 169.6 NM<br><br><u>ORBIT DIR:</u> A/L (40)<br><br><u>AIM PT:</u> Close-In<br><br><u>MLGTD:</u> 2040 FT<br>335:21:25:09Z<br>VEL: 219 KGS<br>211 KEAS<br>HDOT: -1.1 FPS<br><br><u>TD NORM 205:</u><br>2482 F<br>Continued... | 1 = 2047 (12)<br>2 = 2052 (7)<br>3 = 2054 (8)<br><br><u>M 3 EOM:</u><br>WEIGHT:<br>221787 LBS<br>X CG:<br>1087.2 IN<br><br><u>LANDING:</u><br>WEIGHT:<br>221712 LBS<br>X CG:<br>1089.0 IN | ET<br>IMPACT<br><br>MET<br>1:14:18<br><br><u>LAT:</u><br>36.202 S<br><br><u>LONG:</u><br>158.215W | DEORBIT:<br>HA 193.1 NM<br>HP 21.9 NM<br><br><u>ENTRY<br/>VELOCITY:</u><br>25863 FPS<br><br><u>ENTRY<br/>RANGE:</u><br>4400NM |   |              |  |   |
|  <p>STS-125 (HST Service) &amp; LON Vehicle on Pads 39A &amp; 39B. LON Vehicle became STS-126 when STS-125 was ppd to 2009. Picture courtesy of Rod Ostoski/KSC-USA.</p> |   |  |  |  |   |   |   |   |              |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                                   | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.  | SRB<br>RSRM<br>AND<br>ET   | ORBIT<br>INC<br>HA/HP | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXP | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|---|--|--|--|--|-----------------------|-----|--------------------------------------|--|
| STS-126/<br>ISS- ULF2<br>Continued<br>... |         | Continued...<br><br>SS EVA 126<br>DOCKED QUEST EVA 49<br>EMU/TETHERED EVA 119<br>SCHEDULED EVA 117<br>DURATION 6:45<br><br>SS EVA 127<br>DOCKED QUEST EVA 50<br>EMU/TETHERED EVA 120<br>SCHEDULED EVA 118<br>DURATION 6:57<br><br>SS EVA 128<br>DOCKED QUEST EVA 51<br>EMU/TETHERED EVA 121<br>SCHEDULED EVA 119<br>DURATION 6:07<br><br>MCC WHITE FLIGHT FCR (54)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>ASC- Bryan Lunney<br>LD/O1- Mike Sarafin<br>O2- Tony Ceccacci FD 1-12<br>- Paul Dye FD 13-EOM<br>Planning- Paul Dye FD 1-3<br>- Kwatsi Alibarufu<br>FD 4-EOM<br>ENT- Bryan Lunney<br>MOD – John Mccullough<br>Team 4- Richard Jones<br><br><u>ISS</u><br>O1 – Holly Ridings<br>LD/O2- Ginger Kerrick<br>O3 – Brian Smith<br>Team 4- Courtenary<br>McMillan<br><br>Continued... | Continued...<br><br><u>TDEL:</u><br>0.000 (P) 0.192 (A)<br><br><u>MAX Q NAV:</u><br>757.6 (P) 750.2 (A)<br><br><u>SRB STG:</u><br>2:04.32(P) 2:06.24(A)<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (MRN):</u><br>2:38 (P) 2:39 (A)<br><br><u>NEG RETURN:</u><br>3:52 3:54<br><br><u>PTA (U/S 157 FPS):</u><br>5:08 5:14<br><br><u>SE TAL (ZZA 104):</u><br>6:01 6:04<br><br><u>PTM (U/S 168 FPS):</u><br>6:07 6:18<br><br><u>SE PRESS 104</u><br>6:54 6:59<br><br><u>MECO CMD:</u><br>8:22.1 8:23.0<br><br><u>VI:</u><br>25819.0 25818.8<br><br><u>OMS-2:</u><br>38:20 38:19.3<br>97.4 FPS 95.9 FPS | Continued...<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u><br>193 KEAS<br>335:21:25:12Z<br><br><u>NLGTD:</u> 6761 FT<br>335:21:25:20Z<br>VEL: 154 KGS<br>146 KEAS<br>HDOT: -6.2 FPS<br><br><u>BRK INIT:</u> 124 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u><br>53 KGS<br>335:21:25:42Z<br><br><u>BRK DECEL FPS<sup>2</sup>:</u><br>AVE 6.2 PK 9.3<br><br><u>WHEELS STOP:</u><br>335:21:26:02Z<br>11180 FT<br><br><u>ROLLOUT:</u><br>9140 FT<br>0:53 M:S<br><br><u>WINDS:</u><br>4H KT 0 KTS<br>OFFICIAL:<br>04004P06 KTS<br>6H OCROSS KTS<br><br><u>DENS ALT:</u> 3234 FT<br><br><u>FLT DURATION:</u><br>15:20:29:30<br><u>S/T:</u><br>1183:15:39:46<br><u>OV-105:</u><br>274:03:35:10<br><u>DISTANCE:</u><br>6,615,109 sm<br><u>TOTAL SHUTTLE</u><br><u>DISTANCE:</u><br>480,274,259 sm | <br><p>Parade of storms during STS-125 &amp; STS-126 launch preps as seen on Sep. 04, 2008: Gustav (inland remnants, upper left) followed by Hanna, Ike, &amp; Josephine. (From:Robert Harvey/DA8)</p>  <p>IKE08-notrack.gif: Hurricane IKE tracking. Category 2 landfall at 2:10 a.m. CDT near Galveston Sep. 13, 2008. (From: JSC Roundup Nov. 2008) Damage from hurricanes cost NASA \$50M this season.</p>  | Continued...<br><br><u>LAUNCH WINDOW:</u><br>Total launch window was 9 minutes 26 seconds with window open at 320:00:50:52Z and close at 320:01:00:18Z. Preferred Launch Time was 320:00:55:39 (In-Plane Time) for a launch window of 4m39s.<br><br><u>LAUNCH DELAYS:</u> None. Launch occurred on time at 320:00:55:39Z, 7:55:39 p.m. EST, Friday, November 14, 2008. Weather on launch day was acceptable. Isolated afternoon showers were observed at 60 miles south of KSC along the sea breeze late in the day. The showers diminished by sunset - not a threat for the evening launch time or RTLS.<br><br><u>TAL WEATHER</u><br>Weather at the TAL sites was forecast/observed GO.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: 1) PE Operational High Q TRN/NOV, 2) OMS Assist, 3) a 52 nautical mile MECO, and 4) Del Psi<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>- FD 11 MMT decision made for a one-day extension for additional on-orbit time for the Urine Processing Assembly (UPA) troubleshooting & processing or possible Distillate Assembly (DA) return.<br>- Weather for landing was quite complex. Both KSC and EAFB were activated on Sunday, November 30, 2008, as possible landing sites. A large upper level low pressure system over the eastern US with a cold front moving across FL were concerns for landing at KSC on Sunday (EOM) & Monday (EOM+1). Spaceflight Meteorology Group (SMG) weather forecasts were "NO GO" for KSC with crosswind, ceiling, precipitation, and thunderstorm flight rule violations. Also, two Tornado Watches were issued for central FL and a third Watch included KSC. A squall line moving east at 20 kts combined with an unstable air mass across south and central FL generated numerous thunderstorms and isolated tornadoes by mid day. The weather continued to deteriorate across central FL, prompting the MMT to assess the possibility of staying on orbit and attempting EOM+1 landing at KSC. The SMG forecasts for that day indicated marginal conditions for a safe return to KSC.<br>After waving off the first opportunity to KSC and with weather conditions deteriorating through the day at KSC, the decision was made to land at EAFB. Weather conditions at EAFB were nearly ideal with light northeast surface winds and mostly clear skies. Endeavour touched down at 335:21:25:09Z (3:25 PM CST, November 30, 2008) on temporary runway 04. This runway was built due to construction and resurfacing of the primary runway.<br><br>Continued...<br><br>At Left: STS126-S-044 --- NASA Administrator Michael Griffin (front) & Associate Administrator for Space Operations Bill Gerstenmaier watch the launch of the Space Shuttle Endeavour from KSC Launch Control Center on Nov. 14, 2008. |                       |     |                                      |  |




# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXP   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|---|--|--|---|-----------------|--------------------|--|-----|--|---|
| STS-126/ISS-ULF2<br><br>Continued...  |         | Continued...<br><br><u>CAPCOMS:</u><br><u>SHUTTLE</u><br>A/E – Alan Poindexter<br>- Greg (Box)<br>Johnson (Wx)<br>LD/O1 – Steve Robinson<br>O2 – Jim Dutton<br>Planning – Shannon Lucid<br>Team 4 - N/A<br><br><u>ISS</u><br>O1- Terry Virts<br>LD/O2- Mark Vande Hei<br>O3 – Robert Hanley<br>Team 4 – N/A |  |    | S126-E-012247 --- Endeavour & Exp 18 crews shared a Thanksgiving meal on middeck: At top Center, Magnus /STSup/FE Exp18. Clockwise from her: Kimbrough/MS, PLT Boe, Yury Lonchakov/FE Exp 18, Bowen/MS (partially visible behind Lonchakov), Pettit/MSDn, Exp 18 CDR Michael Fincke, Chamitoff/MS, Stefanyshyn-Piper/MS, CDR Ferguson (partially visible top Lt). |                 |                    |  |     | Continued...<br><br><u>FIRSTS/SECONDS:</u><br>- First water regeneration system to recycle urine into drinking water delivered and installed on ISS.<br>- First flight OI-33 Flight Software. Several minor changes made to improve Post MECO attitude control and reduce the risk of recontact with the ET.<br>- First flight of new SSME controller S/W to downlink Advanced Health Management System (AHMS) data on-orbit - provides backup to MADS data.<br>- First flight of redesigned EVA Prime Flight Glove TMG, a Turtleskin® reinforcement layer sandwiched between molded palm and RTV on thumb and index finger and new RTV-3145.<br>- First flight of ET redesigned LO <sub>2</sub> -to-Intertank Flange closeout per RTF B/L Plan<br>- First flight of ATK BSMs in both forward and aft positions.<br>- First Flight of BSM Forward Segment Grain Redesign - eliminated waiver.<br>- First flight of SRB Installed Enhanced Data Acquisition System (EDAS) Units and Instrumentation.<br>- First flight of SRB Redesigned Frangible Nut with Pyrotechnic Crossover Assembly to help prevent stud hang-up.<br>- A Second: "World Toilet Organization (WTO) is a global nonprofit organization committed to improving toilet and sanitation conditions worldwide. World Toilet Day November 19 <sup>th</sup> - During this mission the crew did their bit for WTD with installation of a new second toilet facility on ISS." |   |
|  |         | STS126-S-024 --- After STS-126 successful launch Launch Director Mike Leinbach (right) performs tie-cutting ceremony on KSC Center Director Bob Cabana in LCC Firing Room. Cabana experienced his first shuttle launch as Center Director.  |  |  |    |                 |                    |  |     | <u>NIGHT LAUNCH: # 31</u> NASA Test Director Charlene Blackwell-Thompson, "Endeavour is ready to go. And we're really excited to share our version of a sunrise with you ..."<br><br><u>RENDEZVOUS: #71</u> Rendezvous and dock with ISS.<br><br><u>EVENTS:</u><br>- At L-1 hr NASA Security was informed of an inbound threat to the Shuttle about two miles off shore. Security sweeps came up all clear. At L-5 min officials determined no threat and cleared Shuttle for launch. The perpetrator of the hoax was later arrested, found guilty and sentenced to jail in November 2010.<br>- <b>FD1:</b> OMS2 ignition at 320:01:33:58.3Z resulted in a 125.7 by 84.6 NM orbit.<br>- FD2: RCC inspection found no areas of concern - focused inspection cancelled on FD4.<br>- T1 maneuver at 321:19:26:48.0Z resulted in a 192.4 by 184.3 NM orbit<br>- FD3: R-Bar Pitch Maneuver was performed. No issues.<br>Docking Contact occurred at 321:22:01:17Z<br>- Hard Dock occurred at 321:22:44:35Z<br>- ISS Hatch opened at 321:24:16:00Z (6:16PM CST, Nov 16, 2008) welcomed by ISS crew.<br><br>Continued...  |   |
|   |         |   |  | S126-E-008741 (20 Nov. 2008) --- Stefanyshyn-Piper (left) and Kimbrough during EVA2 continue removing debris and applying lubrication around starboard SARJ. |   |                 |                    |  |     |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-200 - STS-126/ULF2

| FLT NO.                                | ORBITER   | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT INC HA/HP | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|---|--|---|--|--|-----------------|-----------------|-----|--|--|
| STS-126/ ISS- ULF2<br>Continued<br>... |  |  |   |  |  |                 |                 |     |  | <p><b>EVENTS:</b> Continued...</p> <ul style="list-style-type: none"> <li>- IELK Seat Liner Transfer at 322:02:50:00Z (8:50 PM CST, Nov 16, 2008). At that time Greg Chamitoff became a member of STS-126 and Sandra Magnus joined the ISS Expedition 18 as Flight Engineer</li> <li>- FD5: Based on review of launch imagery, the MMT decided that the focused inspection of the Orbiter heat shield was not required.</li> <li>-FD5: EVA 1: Piper &amp; Bowen transferred the Nitrogen Tank Assembly (NTA) from the External Stowage Platform (ESP)-3 to Lightweight MPESS Carrier (LMC), followed by the Flex Hose Rotary Coupler (FHRC) transfer from LMC to ESP-3. JEM EFBM Multi-Layered Insulation (MLI) Cover was removed in prep for c/o of EFBM (to be installed on 2JA later in 2009). Stbd SARJ trundle bearing assembly (TBA) #10 and #6 were replaced, and the stbd race ring was partially cleaned and lubed. A crew equipment bag was inadvertently released during the EVA, but there was sufficient redundant cleaning and lube equipment to finish scheduled tasks. EVA 1 duration 6:52.</li> <li>- FD6: Home improvements continued aboard ISS with installation of two new bedrooms and preparations to activate the water recycling facility.</li> <li>- FD7: EVA2: Piper &amp; Kimbrough relocated the CETA carts in prep for 15A install of S6 solar array upcoming in Feb. 2009; SSRMS Latching End Effector (LEE) A snares were lubricated; all stbd SARJ cleaning and lube objectives were completed except for cleaning under covers 11 and 12; &amp; 4 more trundle bearing assemblies were replaced. EVA was terminated slightly early due to high CO2 readings in Kimbrough's suit. EVA2 duration 6:45. <b>[During this EVA the ISS marked the 10<sup>th</sup> Anniversary of launching its first element - the Russian-built Zarya control module. "It's hard to believe it's been 10 years," said Kirk Shireman, NASA's Deputy Manager for ISS, who remembers it being a cold day on the steppes of Kazakhstan.]</b></li> <li>- FD9: UPA anomalous shutdown due to centrifuge speed below limits &amp; high motor current.</li> <li>- FD9: EVA3: Piper &amp; Bowen continued cleaning of ISS stbd SARJ; R&amp;R'ed the remaining TBA; and cleaned area around SARJ's drive lock assemblies. EVA3 duration 6:57.</li> <li>- FD11:EVA4: Bowen &amp; Kimbrough completed stbd and port SARJ lube tasks; P1 lower inboard camera installed in camera port 7; external facility berthing mechanism latch bolt retracted via EVA override and cover reinstalled; JEM GPS A installed and heaters checked out ok, JEM GPS B deferred to stage or next flight; and, no get-ahead radiator imagery was taken. EVA4 duration 6:07.</li> <li>- SARJ put back in autotrack at 330:00:35 GMT (post-EVA).</li> <li>- FD12: UPA processing was completed for the docked mission.</li> </ul> <p><b>Transfers:</b></p> <ul style="list-style-type: none"> <li>- 16,390 lbs of hardware transferred to ISS (Leonardo &amp; middeck)</li> <li>- 3,642 lbs of hardware returned from ISS to Endeavour (inside)</li> <li>- 25 lbs O2 transferred to ISS</li> <li>- FD15: Undocked at 333:14:47:26Z followed by Sep-1, Sep-2 and Sep-3; OBSS surveys on starboard, nose cap and port; and LDRI downlink.</li> <li>- Communications blackout during Entry: "There [were] a few drop outs but nothing big around GMT 335:21:09 d:h:m."</li> </ul> |
|  |   | S126E-008178 (18 Nov. 2008) --- Pettit installs the Water Recovery System (WRS) rack in Destiny lab. |   |  |  |                 |                 |     |  | <p>Pawel-Warchal-EndISS281108_1227890243.jpg: Impressive photo taken by Polish astronomer just after Shuttle/ISS undocking.</p> <p><b>SIGNIFICANT ANOMALIES:</b><br/><u>Orbiter:</u></p> <ul style="list-style-type: none"> <li>-The Fuel Cell 1 S/N P760106 Hydrogen Flowmeter Measurement Began Drifting High And Erratic At 320/12:36 GMT.</li> <li>- MER-02, LV57 E2 GH<sub>2</sub> FCV, After Engine Throttle up E2 GH<sub>2</sub> Line Shows a Drop of 200 Psi</li> <li>- MPS Helium Bottle Lost 140 Psi During Ascent, OMRSD Allows 60 Psi Max. (MER-10)</li> <li>- GNC Bypass of Ku-Band Radar Data</li> <li>- Tile Damage on Edge .65l x .23w x .05d</li> </ul> <p><u>KSC:</u></p> <ul style="list-style-type: none"> <li>- RDUnassigned - Column parity errors on all ME FEPs.</li> <li>- IRAMS Failed at GMT Rollover.</li> </ul> <p><u>SRB:</u></p> <ul style="list-style-type: none"> <li>- STS126/Bi136 Squawk 126-001: HDP 3 Blast Container Debris Containment Failure</li> </ul> <p><u>RSRM, SSME, &amp; ET:</u> None.</p> <p><u>MOD:</u></p> <ul style="list-style-type: none"> <li>- Updating Minimum EPS Consumables</li> <li>- Loss of Crewlock Bag during Eva #1</li> <li>- Over Torque of Trundle Bearing Assembly Mount</li> <li>- Middeck Return Item Weights Missing</li> <li>- Debris Released Near the LH2 T-0 Plate</li> </ul> <p><u>Integration:</u></p> <ul style="list-style-type: none"> <li>- SM GPC Failure to Send GCIL Commands</li> <li>- Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)</li> </ul>  |
|  |  |  |   |  |  |                 |                 |     |  | <p>296595main_ED08-0306-131c_946-710.jpg: STS-126 Ferry Flight in route to KSC</p>   |

## Page 2-201 - STS-119/15A

[illegible]

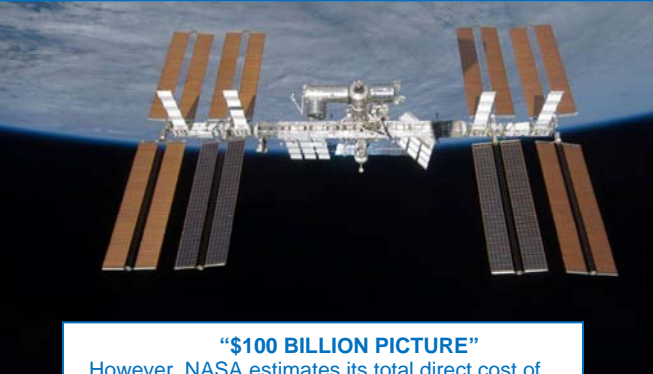




# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.                               | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N.  | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP   |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---------------------------------------|---------|--|--|---|---|--------------------|--|--|-----|--|--|
| STS-119/<br>ISS- 15A<br>Continued ... |         | <div>Continued...</div> <div>SS EVA 131<br/>DOCKED QUEST EVA 54<br/>EMU/TETHERED EVA 124<br/>SCHEDULED EVA 122<br/>DURATION 6:27<br/>MCC WHITE FCR (55)</div> <div><u>FLIGHT DIRECTORS:</u><br/><u>SHUTTLE:</u><br/>ASC/ENT- Richard Jones<br/>LD/O1- Paul Dye<br/>O2- Mike Sarafin (FD1- FD12)<br/>O2-Tony Ceccacci (FD13-EOM)<br/>O3- Richard LaBrode (Prelaunch – FD1)<br/>O3- Norman Knight (FD2-FD8)<br/>O3- Bryan Lunney (FD9-EOM)<br/>Planning- Norm Knight<br/>- Bryan Lunney<br/>MOD – John Mccullough<br/>Team 4 - Tony Ceccacci</div> <div>Continued...</div> | <div>Continued...</div> <div><u>MECO CMD:</u><br/>8:23.6 8:23.8</div> <div><u>VI:</u><br/>25819.0 25819.6</div> <div><u>OMS-2:</u><br/>38:00 38:30.0<br/>97.7 FPS 96.1 FPS</div> | <div>Continued...</div> <div><u>WINDS:</u><br/>15H KT 0.3L<br/>KTS<br/>OFFICIAL:<br/>15017P23 KTS<br/>X1P1H17P23 KTS</div> <div><u>DENS ALT:</u> 1718 FT</div> <div><u>FLT DURATION:</u><br/>12:19:29:42<br/><u>S/I:</u><br/>1196:11:09:28</div> <div><u>OV-103:</u><br/>318:03:39:51</div> <div><u>DISTANCE:</u><br/>5,304,106 sm</div> <div><u>TOTAL SHUTTLE DISTANCE:</u><br/>485,578,259 sm</div> | <div>Continued...</div> <div>ABOVE: STS-119 launch panorama into twilit sky. Photo by Ryan R. Smith (KSC-BOE-K2)<br/><a href="http://www.ryansmithphotography.com/">http://www.ryansmithphotography.com/</a></div> <div>BELOW: S119-E-007747 --- STS-119 &amp; Exp18 crews in ISS Harmony. From left (bottom row): PLT Antonelli, CDR Archambault, &amp; Acaba/MS. From left (middle row): Magnus/MS, Exp 18 CDR Michael Fincke, Yuri Lonchakov/Exp18FE(RSA), &amp; Koichi Wakata/Exp18FE (JAXA). From left (top row) Swanson/MS, Arnold/MS, &amp; Phillips/MS.</div> |                    | <div>Continued...</div> <div><u>LAUNCH DELAYS:</u> None. Launch occurred on time at 074:23:43:44Z, 7:43:44 p.m. EST, Sunday, March 15, 2009. Launch weather was relatively benign at KSC. A sea breeze developed at KSC and moved west of the Banana River about 3 hours prior to launch. The movement of the sea breeze inland produced favorable weather conditions with widely scattered clouds.</div> <div><u>TAL WEATHER</u><br/>TAL sites at both Zaragoza and Moron, Spain were acceptable for launch due to a high pressure system. Winds at Istres were out of limits following the passage of a cold front the day prior to launch, but launch proceeded with two acceptable TAL sites.</div> <div><u>PERFORMANCE ENHANCEMENTS:</u><br/>Include the standard set plus: 1) PE Operational High Q WIN/MAR, 2) OMS Assist, 3) 52 nautical mile MECO, &amp; 4) Del Psi</div> <div><u>FLIGHT DURATION CHANGES/LANDING:</u><br/>- When STS-119 launch was slipped to March 15, 2009, (due to earlier scrub) the mission duration was reduced from 14 to 13 days to accommodate a Russian Soyuz mission to ISS later in the month. This also reduced number of EVA's from 4 to 3.<br/>- For first KSC landing opportunity weather was no go with cloud decks building in at lower than anticipated broken (5/8) at 3000. Weather improved as did the wind direction. Discovery was given "Go" to land on second KSC opportunity. Landing occurred at 087:19:13:26Z (2:13:26 PM CDT Saturday, 03/28/09).</div> <div><u>FIRSTS/SECONDS/LASTS:</u><br/>- SSME ECP 1514 – LPOTP Bearing Ball Process Change<br/>- SRB Hold Down Post Debris Containment mod<br/>- S&amp;MA: Orbiter LH<sub>2</sub> T-0 Umbilical Ice: Update to IDBR-01 and NSTS-60559 to reflect new expected debris source.<br/>- Last to be installed on ISS, the 45-foot S6 aluminum girder weighing more than 31,000 pounds was the first truss segment built (stored at KSC for six years).<br/>- Second time a bat attempted to fly into space on Space Shuttle ET; coincidentally Koichi Wakata was on both flights.<br/>- Discovery served as a hypersonic test bed during entry for new heat shield tiles in development for NASA's next-generation spacecraft.</div> <div>Continued...</div> |  |     |  |  |





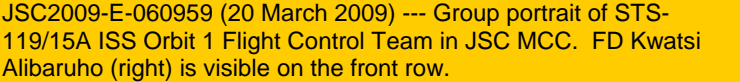
# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---------|---|---|---|--|-----------------|-------|--|-----|--|--|
| STS-119/ ISS- 15A<br>Continued ...  |         | Continued...<br><br>ISS<br>LD/O1 - Kwatsi Alibaruho<br>O2 - Heather Ranick<br>O3 - David Korh<br>Team 4 - Robert dempsey<br><br><u>CAPCOMS:</u><br><u>SHUTTLE</u><br>A/E – George Zamka<br>Asc (Wx)- C. Hobaug<br>Ent (Wx)- Al Poindexter<br>LD/O1 – George Zamka<br>O2 – Greg (Box) Johnson<br>Planning – Shannon Lucid<br>Team 4 - N/A<br><br><u>ISS</u><br>LD/O1 – Rick Davis<br>O2- Lucia McCullough<br>O3 – Jay Marschke<br>Team 4 – N/A |   |   |  |                 |       |  |     |  | Continued... <u>FIRSTS/SECONDS/LASTS:</u><br><br>- March 27, 2009: In a rare example of overlapping space missions, a U.S. space shuttle [STS-119] is set to return to Earth on Saturday just a few hours after a Russian Soyuz arrives at the ISS. Together the crews of the three craft total 13 people, tying the record for humans in space, first set 14 years ago this month. [Robert Pearlman - collectSPACE.com]<br><br><u>MCC ROSES:</u><br>This was the 100 <sup>th</sup> flight since the Challenger accident that a beautiful bouquet of roses was delivered to the Houston MOCR to celebrate each mission since the landing of STS-26 in 1988. In 1989 it was determined that the roses were sent by the Shelton family (Mark, MacKenzie & Terry) of Bedford, TX. On March 27, 2009, the Sheltons personally delivered their 100 <sup>th</sup> bouquet in recognition of STS-119. They received a warm welcome in the MOCR, led by James "Mill" Hefflin, JSC Associate Director, Technical. They also received several JSC mementos for their kindness and dedication to the Space Program.<br><br><u>NIGHT LAUNCH: # 32</u> (Into twilight sky)<br><br><u>RENDEZVOUS: #72</u> Rendezvous and dock with ISS.<br><br><u>EVENTS:</u><br>- FD1: OMS2 ignition at 075:00:22:14Z resulted in a 126.0 by 84.9 NM orbit.<br>- FD2: RCC inspection found no areas of concern<br>- T1 maneuver at 076:18:35:39.0Z resulted in a 196.8 by 183.3 NM orbit<br>- FD3: R-Bar Pitch Maneuver was performed. No issues.<br>- Docking Contact occurred at 076:21:19:49Z, <u>St. Patrick's Day</u><br>- Hard Dock, hooks closed, occurred at 076:21:33:59Z<br>- ISS Hatch opened at 076:23:22:59Z (6:09 PM CDT, March 17, 2009) welcomed by ISS crew.<br>- IELK Seat Liner Transfer at 077:02:00Z (9:00 PM CDT) March 17, 2009). At that time Sandra Magnus became a member of STS-119 and Koichi Wakata joined the ISS Expedition 18 as Flight Engineer.<br>- FD5: Based on review of launch imagery, MMT cancelled FD6 focused inspection of Orbiter heat shield.<br>- FD5: EVA 1: Steve Swanson & Ricky Arnold: Activities included: S6 Connected to ISS, SABB Unstow, PCDF-PU Transfer, PVR Deploy, and 1B & 3B solar arrays deployed EVA1 duration 6:07.<br><br>Continued... |
| S119-E-009765 (25 March 2009) --- ISS USOS assembly complete as seen during Shuttle fly-around [labeled the "\$100 Billion Picture" by ISS Lead Flight Director Kwatsi Alibaruho]. The ISS truss backbone measures 361 feet - longer than a football field. |         |   |  <p><b>"\$100 BILLION PICTURE"</b><br/>However, NASA estimates its total direct cost of building ISS at \$58.5 billion since 1985.</p>   |   |  |                 |       |  |     |  |  |
|   |         |   |  <p>S119E007312</p> <p>S119-E-006673 --- Swanson (center) and Arnold (partially obscured above Swanson) during EVA 1 connected bolts to attach S6 truss to S5, plugged in power and data connectors, prepared a radiator for cooling, and readied new solar arrays.</p> |   |  |                 |       |  |     |  |  |
|   |         |   |  <p>SEE: <u>MCC ROSES</u>: Above right under Mission Highlights Column</p>   |   |  |                 |       |  |     |  |  |





# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-204 - STS-119/15A

| FLT NO.                               | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET  | ORBIT<br><br>INC<br>HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |  |
|---------------------------------------|---------|--|---|--|---|---|---------------------------|--|-----|--|--|--|--|
| STS-119/<br>ISS- 15A<br>Continued ... |         | <div>Two of FCT's That Participated In ISS USOS Complete</div>    |   |  |   | <div>In JSC MCC at Landing Support Officer (LSO) console: On left, Marty Linde/USA , Lt. Col. Dave Impicini/USAF (standing), Wayne Hensley/USA (on phone), &amp; Brenton Hartung (student observer in rear). Laughter caused by photographer always catching Wayne on telephone.</div>    |                           |  |     | <div>Continued... <b>EVENTS:</b><br/><br/>Downlinked, P3 UCCAS Deploy unsuccessful, temporary tethers installed, S3 PAS Deploy deferred to EVA3, and Z1 Patch Panel Reconfig unsuccessful. EVA2 duration 6:30.<br/>- FD8: CDR Lee Archambault maneuvered the Shuttle-ISS "stack" to avoid a 9-year-old piece of Chinese space junk (4" fragment) that could have been a close encounter during upcoming EVA3. (A 4' fragment from a Russian satellite had previously passed at a safe distance prior to Shuttle/ISS docking.)<br/>- FD9: EVA3: Joe Acaba &amp; Ricky Arnold: Activities included: UCCAS troubleshooting; tethered in place, CETA cart relocation and SSRMS LEE B lube completed. Numerous get aheads accomplished: CETA coupler, S1/S3 SSAS panel BBC reconfig, S1 FHRC outboard p-clamps released 2 of 6 (#5, #6), and retrieved bungee caddy from Nadir STBD A/L toolbox. EVA3 duration 6:27.<br/>- Transfers:<br/>- 32,962 lbs of hardware transferred to ISS (S6 Truss &amp; Middeck)<br/>- 1963 lbs of hardware returned from ISS to Discovery (middeck)<br/>- 1142 lbs of water transferred to ISS<br/>- FD11: Undocked at 084:19:53:26Z<br/>- Flyaround initiated 084: 20:19Z<br/>- Communications blackout during Entry occurred at GMT 87:18:47 to 87:18:52 d:h:m due to plasma effect.<br/><br/><b>SIGNIFICANT ANOMALIES:</b><br/><u>Orbiter:</u><br/>- Galley Water Leakage.<br/>- WLES Group 2 Sensor S/N# 1033 Time Slip<br/>- During MM/OD Monitoring With Group 2 Sensors, Sensor S/N 1024 On The Port Wing Unexpectedly Dropped Out Of On-Orbit Mode After 5-6 Hrs Of Monitoring.<br/>- AVIU S/N 1031 Failure<br/>- Failed Camera Shutter Actuation.<br/>- Incorrect SORG Needle Installed<br/>- V07P9379A Dropped To Lower Limit (Unit Step) During STS-119 Ascent<br/>- Aft Stub Tile on the Upper Body Flap Was Suspect to be Damaged During FD3 On-Orbit Inspection. During Post-Flight Inspection the V070-395018-144 Tile Was Verified As Damaged.<br/><br/>Continued at left...</div> |  |  |  |
|                                       |         | <div>JSC2009-E-060960 (20 March 2009) --- Group portrait of Shuttle STS-119 Orbit 1 Flight Control Team in JSC MCC. FD Paul Dye (left) is visible on the front row.</div>            |   |  |   | <div>Continued... <b>SIGNIFICANT ANOMALIES:</b><br/><br/>- Ground Imagery Showed That When Thruster F4D's Tyvek Rain Cover Released at 5:28 Sec Met (~93fps Or 63 Mph), A ~21 Inches x ~7.4 Inches Piece Remained Attached to the Thruster Lip as Shown In Figures 1 and 2.<br/><u>KSC:</u><br/>- STS-119 Post Launch Debris<br/><u>SRB:</u> <u>RSRM:</u> <u>SSME:</u> None.<br/><u>ET:</u><br/>-During Initial Launch Attempt of STS-117/ET-127, a GHz Leak was Detected at Approximately One Minute After Start of LH<sub>2</sub> Topping<br/><u>MOD:</u><br/>-Inadvertent Abort Light Command Sent from FDO<br/><u>Integration:</u><br/>-Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)<br/>-High GHz Concentrations at the Ground Umbilical Carrier Plate (GUCP)<br/>-MPS LH<sub>2</sub> ORB Umbilical Plate Gap Pressure LCC Violation<br/>-Stub Tile Damage</div> |                           |  |     |  |  |  |  |
|                                       |         | <div>JSC2009-E-060959 (20 March 2009) --- Group portrait of STS-119/15A ISS Orbit 1 Flight Control Team in JSC MCC. FD Kwatsi Alibaruho (right) is visible on the front row.</div>  |   |  |   |   |                           |  |     |  |  |  |  |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER   | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET  | ORBIT  |   | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---|--|--|--|---|--|--|---|---|--|---|
| STS-125<br><br>SEQ FLT # 126<br><br>KSC-126<br><br>PAD 39A (49)<br><br>MLP-2<br><br>5 <sup>TH</sup> & Final HST Service Flight | OV-104 (Flight 30) ATLANTIS<br><br>OMS PODS LPO4-30 RPO1-37 FRC4-30 | CDR:<br>Scott Altman (Flt 4 - STS-90, STS-106, STS-109)<br>P787/R237/V161/M207<br><br>PLT<br>Gregory C. Johnson<br>P788/R337/M292<br><br>MS1<br>Michael Good<br>P789/R338/M293<br><br>MS2<br>Megan McArthur<br>P790/R339/F46<br><br>MS3<br>John Grunsfeld (Flt 5-STS-67, STS-81, STS-103, STS-109)<br>P791/R191/V133/M167<br><br>MS4<br>Mike Massimino (Flt 2 - STS-109)<br>P792/R275/V204/M241<br><br>MS5<br>Andrew Feustel<br>P793/R340/M294<br><br>SS EVA 132 EMU/TETHERED EVA 125 SCHEDULED EVA 123 DURATION 7:20<br><br>SS EVA 133 EMU/TETHERED EVA 126 SCHEDULED EVA 124 DURATION 7:56<br><br>Continued... | KSC 39A<br>131:18:01:56Z<br>2:01:56 PM EDT (P)<br>2:01:56 PM EDT (A)<br>Monday (14)<br>05/11/09 (8)<br><br>LAUNCH WINDOW:<br>59M 45S (Total)<br>41M 50S (Preferred)<br><br>EOM PLS: KSC<br><br>TAL: MRN<br>TAL WX: None.<br><br>SELECTED:<br>RTLS: KSC15 N/N<br>TAL: MRN20 CI/N<br>AOA: KSC15 N/N<br>1 <sup>ST</sup> DAY PLS: NOR17 N/N<br><br>TDEL:<br>0:000 (P) -0.448 (A)<br><br>MAX Q NAV:<br>740.95 (P) 734.75 (A)<br><br>SRB STG:<br>2:04.16(P) 2:04.32(A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN):<br>2:48 (P) 2:55 (A)<br><br>NEG RETURN:<br>3:53 (P) 3:56 (A)<br><br>PTA (U/S 483 FPS):<br>4:11 (P) 4:12 (A)<br><br>PTM (U/S 500 FPS):<br>5:09 (P) 5:12 (A)<br><br>Continued... | EDW22 CONC<br>EDW 53 CONC 34<br>144:15:39:04Z<br>10:39:04 AM CDT<br>Sunday (16)<br>05/24/09 (11)<br><br>DEORBIT BURN:<br>144:14:24:41.OZ<br><br>X RANGE: 405.6 NM<br><br>ORBIT DIR: D/L (50)<br><br>AIM PT: Nominal<br><br>MLGTD: 3863 FT<br>144:15:39:04Z<br>VEL: 192 KGS<br>200 KEAS<br>HDOT: -2.5 FPS<br>Continued... | 104/104/109%<br><br>PREDICTED:<br>100/104.5/104.5/72/104.5<br><br>ACTUAL:<br>100/104.5/94/72/104.5<br><br>1 = 2059 (3)<br>2 = 2044 (11)<br>3 = 2057 (4)<br><br>M 3 EOM:<br>WEIGHT:<br>225509.5 LBS<br>X CG: 1078.3 IN<br><br>LANDING:<br>WEIGHT:<br>225898 LBS<br>X CG: 1080.9 IN | BI-137<br><br>RSRM 105<br><br>ET-130<br><br>SLWT 34<br><br>ET<br>IMPACT<br>1:27:55 MET<br><br>LAT:<br>16.699 N<br><br>LONG:<br>147.375 W | 28.45 (51)<br><br>DIRECT INSERTION<br><br>POST OMS2:<br>298.1 NM<br>X 106.8 NM<br><br>DEORBIT:<br>HA 294.3 NM<br>HP 26.4 NM<br><br>ENTRY VELOCITY:<br>26046 FPS<br><br>ENTRY RANGE:<br>4267 NM | 01-32 (5)<br><br>CARGO:<br>32418 LBS<br><br>PAYLOAD CHARGEABLE:<br>22254 LBS<br><br>DEPLOYED:<br>4694 LBS<br><br>NON-DEPLOYED:<br>17560 LBS<br><br>MIDDECK:<br>0 LBS<br><br>SHUTTLE ACCUMULATED WEIGHTS:<br>DEPLOYED:<br>1524432 LBS<br><br>NON-DEPLOYED:<br>1621371 LBS<br><br>CARGO TOTAL:<br>4054222 LBS<br><br>PERFORMANCE MARGINS (LBS):<br>FPR: 2651<br>FUEL BIAS: 1063<br>FINAL TDDP: 1689<br>RECON:2499<br><br>PAYLOADS:<br>PLB:<br>HST SM4, ICBC 3D<br><br>MIDDECK:<br>HST SM4<br><br>5 CRYO TANK SETS<br>RMS (83)<br>SRMS, OBSS | <i>Brief Mission Summary:</i> STS-125 was the 5 <sup>th</sup> and final service mission (SM) visit to the 19 year old Hubble Space Telescope (HST) deployed on STS-31 in 1990. This was the 4 <sup>th</sup> planned SM for HST. (The 3 <sup>rd</sup> SM was conducted in two parts, 3A on STS-103 & 3B on STS-109.) HST improvements included a new camera, a new spectrograph, repair of two other instruments, and replacement of six batteries and six gyroscopes. These improvements resulted in a higher definiton view of the universe and HST life extension into the next decade. A launch- on-need (LON) vehicle, STS-400, was readied on Pad B for potential crew rescue since there was no ISS safe haven on this misssion. STS-400 release from rescue duty occurred on May 21 <sup>st</sup> , 2009, as the STS-125 crew prepared for the first deorbit/landing opportunity.<br><br><b>KSC W/D:</b><br>OPF Run 1: 178+2H+3Wx OPF Run 2: 120+11H<br>VAB Run 1: 12+0C VAB Run 2: 8+0C<br>PAD Run 1: 40+2C PAD Run 2: 38+4C<br>Total Work Days = 396 (OPF Processing occurred over a total time period of 314 days.)<br><br><b>POSTPONEMENTS:</b><br>- Added STS-125 to FDRD - launch date of 08/07/08 on 06/29/07.<br>- Ppd. to 08/28/08 on 02/14/08. Slip due to ECO sensor problems experienced during December launch attempt of STS-122.<br>- Ppd. to 10/08/08 on 05/27/08. Slip due to delays in delivery of ET 127 & ET-129 (STS-400).<br>- Ppd. to 10/10/08 on 09/08/08. Slip due to Hurricane Faye impacts to HST payload readiness.<br>- Ppd. to 10/14/08 on 09/24/08. Slip due primarily to training time lost in the aftermath of Hurricane Ike.<br>- Ppd. to NET Mid-Feb 2009 on 10/02/08. Slip due to HST on-orbit failure of A-side of Control Unit Science Data Formatter.<br>- Ppd. to NET Mid-May 2009 on 10/30/08. Slip due to checkout problems with HST spare control unit.<br>- Selected May 12, 2009 launch date on 12/04/08.<br>- Advanced from 05/12/09 to 05/11/09 on 05/01/09. Advancing one day provided a 3 <sup>rd</sup> launch opportunity before range conflicts.<br><br><b>LAUNCH SCRUBS:</b> None.<br><br>Continued... |  |   |



S125-E-012154 --- HST Service Crew pose on middeck . Front row (left to right): PLT Johnson, CDR Altman, and McArthur/MS. Back row (left to right): Good/MS, Massimino/MS, Grunsfeld/MS, and Feustel/MS.

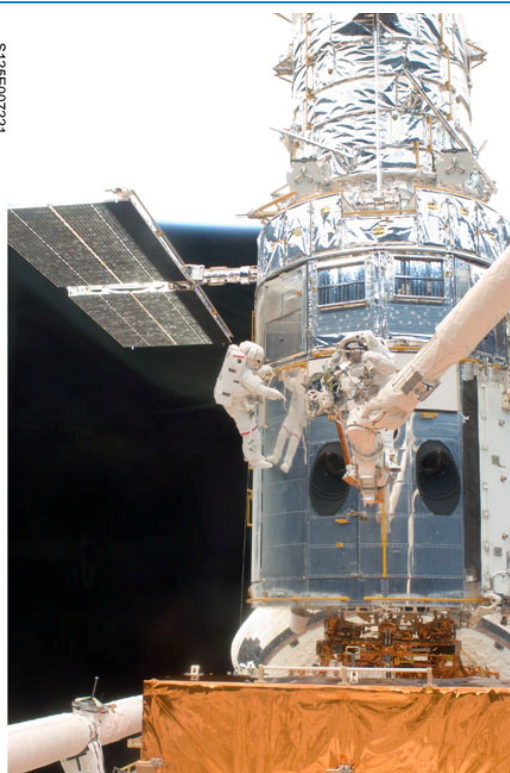


S125-E-012154 --- HST Service Crew pose on middeck . Front row (left to right): PLT Johnson, CDR Altman, and McArthur/MS. Back row (left to right): Good/MS, Massimino/MS, Grunsfeld/MS, and Feustel/MS.

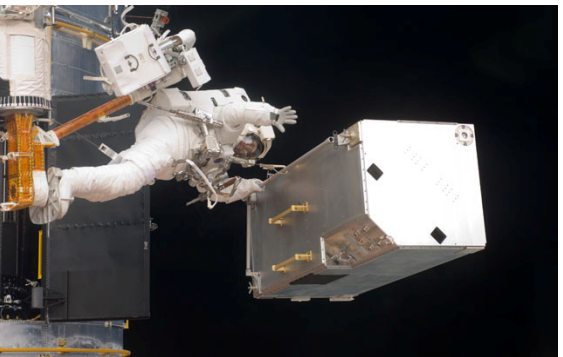
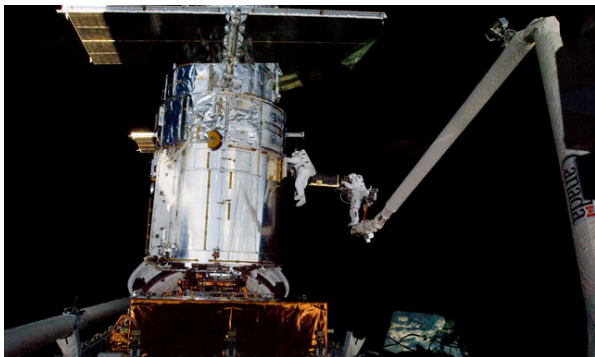






# SPACE SHUTTLE MISSIONS SUMMARY



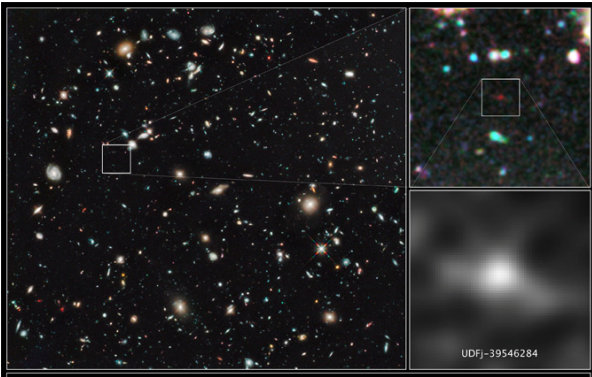
| FLT NO.                  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC<br>HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--------------------------|---------|--|---|---|---|--------------------------|-----------------------|--|-----|---|--|
| STS-125<br>Continued ... |         | Continued...<br><br>SS EVA 134<br>EMU/TETHERED EVA 127<br>SCHEDULED EVA 125<br>DURATION 6:36<br><br>SS EVA 135<br>EMU/TETHERED EVA 128<br>SCHEDULED EVA 126<br>DURATION 8:02<br><br>SS EVA 136<br>EMU/TETHERED EVA 129<br>SCHEDULED EVA 127<br>DURATION 7:02<br><br>MCC WHITE FLIGHT FCR (56)<br><br><u>FLIGHT DIRECTORS:</u><br>ASC/ENT- Norm Knight<br>LD/O1- Tony Ceccacci<br>O2- Rick LaBorde<br>Planning- Paul Dye<br>MOD – John Mccullough<br>Team 4- Bryan lunneyi<br><br><u>CAPCOMS:</u><br>A/E - Greg (Box) Johnson<br>- Eric Boe (Wx)<br>LD/O1 – Dan Burbank<br>O2 – Alan poindexter<br>Planning – Janice Voss<br>Team 4 - N/A | Continued...<br><br><u>SE BYD 104</u><br>5:39 (P) 5:46 (A)<br><br><u>NEG MRN (2@104)</u><br>5:59 (P) 6:02 (A)<br><br><u>SE PRESS 109</u><br>6:22 (P) 6:29 (A)<br><br><u>MECO CMD:</u><br>8:23.4 (P) 8:24.3 (A)<br><br><u>VI:</u><br>26088.0 (P)<br>26086.0 (A)<br><br><u>OMS-2:</u><br>43:46 (P) 43:45.0 (A)<br>142.5 (P) 139.7 (A)<br>FPS<br><br>-----<br>Continued from col @ right...<br><br><u>FLT DURATION:</u><br>12:21:37:18<br><br><u>S/T:</u><br>1196:08:46:46<br><br><u>OV-104:</u><br>271:04:42:58<br><br><u>DISTANCE:</u><br>5,276,106 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>490,854,365 sm | Continued...<br><br><u>TD NORM 205:</u><br>3201 FT<br><br><u>DRAG CHUTE DEPLOY:</u><br>189 KEAS<br>144:15:39:06Z<br><br><u>NLGTD:</u> 7134 FT<br>144:15:39:15Z<br><u>VEL:</u> 137 KGS<br>141 KEAS<br><u>HDOT:</u> -6.3 FPS<br><br><u>BRK INIT:</u> 96 KGS<br><br><u>DRAG CHUTE JETTISON:</u><br>55 KGS<br>144:15:39:40Z<br><br><u>BRK DECEL FPS²:</u><br>AVE 2.8 PK 7.4<br><br><u>WHEELS STOP:</u><br>144:15:40:13 Z<br>12367 FT<br><br><u>ROLLOUT:</u><br>8504 FT<br>1:09 M:S<br><br><u>WINDS:</u><br>16H KT 0 KTS<br><u>OFFICIAL:</u><br>23016P20 (X 2 PK 2<br>HD 16 PK 20)<br><br><u>DENS ALT:</u> 3848 FT<br><br>Continued @ left ... |    |                          |                       |  |     | Continued...<br><br><u>LAUNCH WINDOW:</u><br>Total launch window was 59M 45S with window open at 131:17:44:01Z and close at 131:18:43:46Z. Preferred Launch Time was 131:18:01:56Z (In-Plane Time) for a launch window of 41M 50S.<br><br><u>LAUNCH DELAYS:</u> None. Launch occurred on time at 131:18:01:56Z, 2:01:56 p.m. EDT, Monday, May 11, 2009. The Spaceflight Meteorology Group (SMG) forecast no flight rule violations for launch or RTLS. The SMG also tracked a large wildfire 18nm northwest of KSC that stayed north of the orbiter track for an RTLS if needed.<br><br><u>TAL WEATHER</u><br>At Moron, the only TAL site for the HST low inclination orbit, a trough of low pressure initially resulted in a "NO GO" with a slight chance of showers within 20nm. Balloon data showed the atmosphere was too dry for showers and the forecast was updated to "GO" at 1636Z. Peak crosswinds of 15.5 kts surpassed the 15kt limit for a brief time at TAL landing, however, the FD had previously stated a peak crosswind of 17kts was acceptable.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: PE Operational High Q TRN/MAY<br><br><u>FLIGHT DURATION CHANGES/LANDING:</u><br>- For both KSC landing opportunities on Friday, May 22 <sup>nd</sup> the unstable weather was no go with low ceilings and thunderstorms expected. Landing was postponed to Saturday (EOM + 1).<br>- KSC weather was no go for EOM+1 with broken low ceilings and thunderstorms. Little change was expected for Sunday (EOM+2) and Monday (EOM+3) as moisture remained abundant over KSC.<br>- KSC landing for Sunday (EOM+2) waived off due to weather. Next opportunity to EDW's was selected on EOM +2 with typical summer weather and mostly clear skies. Landing occurred at 144:15:39:04Z (10:39:04 AM CDT Sunday, 05/24/09).<br><br><u>FIRSTS/LASTS:</u><br>- First mission post-STS-107 incident without ISS safe haven. LON STS-400 mission was on standby on PAD 39B. "First time since 2001 that two such birds have simultaneously perched on NASA's twin shuttle launch pads" - Todd Halvorson, Florida Today.<br>- 116 new EVA tools (GSFC) were developed to meet unique demands of this HST SM.<br>- First flight of food bars and Metamucil wafers<br>- First ET build with elimination of "Hand Pack Ablator (SLA)"<br><br>Continued... |  |
|                          |         |  |   |   | <b>S125-E-007221 (14 May 2009)-- Grunsfeld &amp; Feustel and mirrored reflection during first HST EVA. Activities included installation of a new WFC3 and SI C&amp;DH unit.</b> |                          |                       |  |     |   |  |

# SPACE SHUTTLE MISSIONS SUMMARY



| FLT NO.  | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.  | SRB RSRM AND ET | ORBIT |       | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|----------------------------------|---|--|---|-----------------|-------|-------|-----|---|---|
|  |         |                                  |   |  |   |                 | INC   | HA/HP |     |   |   |
| STS-125<br>Continued ...   |         |                                  |   |  |   |                 |       |       |     |   |   |
|  <p>S125-E-008120 (16 May 2009)-- Andrew Feustel moves Corrective Optics Space Telescope Axial Replacement (COSTAR) in 3rd EVA to upgrade HST.</p> |         |                                  |   |  |  <p>S125-E-009918 (18 May 2009) "Hugging the Hubble!" - Grunsfeld, on end of RMS, and Feustel, conduct mission's fifth and final HST service EVA: Replaced batteries, a Fine Guidance Sensor, and three thermal blankets (NOBL).<br/><u>NOTE:</u> Dr. John M. Grunsfeld was later appointed Deputy Director of the Space Telescope Science Institute (STScI) in Baltimore, Md. effective January 4, 2010.</p> |                 |       |       |     | <p>Continued... <u>FIRSTS/LASTS:</u></p> <ul style="list-style-type: none"> <li>- First flight of ATK BSM's in both forward and aft positions</li> <li>- SRB Frangible nut redesigned with pyrotechnic crossover assembly</li> <li>- Mike Massimino first to 'Tweet' from space, through email to JSC to his Twitter.</li> <li>- First job offer in space: John Grunsfeld, while flying high in space, was named an adjunct professor at the University of Colorado at Boulder</li> <li>- Fifth &amp; last HST Service mission.</li> </ul> <p><u>NIGHT LAUNCH:</u> N/A</p> <p><u>RENDEZVOUS: #73</u> Rendezvous with HST.</p> <p><u>EVENTS:</u></p> <ul style="list-style-type: none"> <li>- FD1: OMS2 ignition at 131:18:45:40.9Z resulted in a 298.1 by 106.6 NM orbit.</li> <li>- T1 maneuver at 133:14:41:56.0Z resulted in a 303.2 by 302.9 NM orbit</li> <li>- FD2: RCC inspection found no areas of concern - no requirement for Focused Inspection.</li> <li>- FD3: HST Grapple by McArthur occurred at 133:17:14Z. Timeline was about 20 min. behind schedule due to a comm. problem with HST that delayed HST prep for capture.</li> <li>- FD4: EVA 1: Grunsfeld &amp; Feustel: Activities included installing and completing good aliveness tests for new WFC3 and SI C&amp;DH unit. The HST can now see farther into space and across a wider spectrum of colors. EVA ran 50 min longer than planned as the crew encountered difficult (aging) latches and bolts. EVA1 duration 7:20.</li> <li>- FD5: EVA 2: Massimino &amp; Good: Activities included Rate Sensor Unit changeouts &amp; Bay 2 Battery checkout. EVA ran long due to the challenges for seating and bolting of RSU's. EVA2 duration 7:56.</li> <li>- FD6: EVA 3: Grunsfeld &amp; Feustel: Activities included replacement of the COSTAR instrument with the Cosmic Origins Spectrograph and repair of the Advanced Camera for Surveys. EVA3 duration 6:36.</li> <li>- FD7: EVA 4: Massimino &amp; Good: Activities included refurbishment of Space Telescope Imaging Spectrograph and replacement of 6 Gyros. EVA 4 duration 8:02 (6th longest in program history).</li> <li>- FD8: EVA 5: Grunsfeld &amp; Feustel: Activities included Bay 3 battery changeout and FGS 2 changeout. On way back to A/L crew found debris liberated from carrier and head under HST. On retrieving the debris, PLSS contact damaged the TPS cover on the Low Gain Antenna (LGA). The LGA cover was reinstalled. The HST was in a good configuration for long term exposure to space. EVA5 duration 7:02.</li> <li>- On departing the telescope, astronaut Grunsfeld called the week a "tour de force of tools and human ingenuity." He also added: "Hubble Isn't Just a Satellite, It Is About Mankind's Quest for Knowledge".</li> <li>- FD9: HST was released at 139:12:57:00Z. This was followed shortly by OBSS late inspection of Atlantis TPS.</li> <li>- During Entry comm blackout occurred at GMT 144/1513 - 1517 due to plasma effect.</li> </ul> |   |
|  <p>JSC2009-E-120479 --- In MCC: Members of the STS-125 Hubble Space Telescope Planning and Orbit Flight Control Team.</p>                        |         |                                  |   |  |  <p>JSC2009-E-118819 --- In MCC: John McCullough (seated foreground), Chief Flight Directors Office; Brent Jett (seated right), Director, Flight Crew Operations; Lead Flight Director Tony Ceccacci (standing, left); and Asc/Des Flight Director Norm Knight (standing, right).</p>  |                 |       |       |     |   |   |



# SPACE SHUTTLE MISSIONS SUMMARY



| FLT NO.                  | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT<br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|--------------------------|---------|----------------------------------|---|--|---|-----------------|--------------------|--|-----|---|---|
| STS-125<br>Continued ... |         |                                  |   |  |   |                 |                    |  |     | <p>After Shuttle release, the HST orbital observatory returns to its cosmic duties, see photos at right and below.</p>   <p>HST Program released the above photos on 09/10/09 taken by the "Refurbished Hubble" (using WFC3). At upper right are two views of: Stars Bursting to Life in Chaotic Carina Nebula. These two images of a huge pillar of star birth demonstrate how observations taken in visible and in infrared light by HST reveal dramatically different and complementary views of an object. Above left is cauldrons of gas at 36K Deg F tearing across space at 600K mph resembling a "butterfly". Above center is NGC 6302 Stephan's Quintet Galactic Wreckage - a clash among members of the quintet revealing stars from young blue stars to aging red stars. See: <a href="http://www.nasa.gov/hubble">http://www.nasa.gov/hubble</a> Credit: NASA, ESA, and the Hubble SM4 ERO Team.</p>  <p>Hubble Ultra Deep Field 2009-2010<br/>Hubble Space Telescope • WFC3/IR</p> <p>NASA, ESA, G. Illingworth and R. Bouwens (University of California, Santa Cruz), and the HUDF09 Team STScI-PRC11-05</p> | <p><b>SIGNIFICANT ANOMALIES:</b></p> <p><u>Orbiter:</u></p> <ul style="list-style-type: none"> <li>- FWD STBD PLB FLOODLIGHT (#2) FAILED DURING STS-125</li> <li>- DURING SSME IGNITION, AN ELECTRICAL ANOMALY OCCURRED THAT CAUSED ASA 1 TO BE LOST.</li> <li>- AFTER CARRIER PANEL REMOVAL AN IN-PLANE CRACK WAS DETECTED AT THE DENSIFICATION LAYER INTERFACE WITH BASE MATERIAL ON TILES V070-395018-143 (SERIAL S83057) AND V070-395018-151 (SERIAL 7HB1DR)</li> <li>- THE CREW DISCOVERED CARRYOVER OR UNPROCESSED CONDENSATE IN THE IMMEDIATE AREA OF THE HUMIDITY SEPARATORS IN THE LOWER EQUIPMENT BAY.</li> <li>- THE IMU FAN DELTA PRESSURE (V61P2869A) WAS OBSERVED TO SLOWLY INCREASE ON FD 12, WITH THE FIRST INCIDENCE OF TOGGING ABOVE THE FLIGHT RULE LIMIT OF 4.71 PSI OCCURRING AT GMT 142/18:22:37.</li> <li>- DURING SSME IGNITION AN ELECTRICAL SHORT OCCURRED ON THE 26VAC EXCITATION CIRCUIT BETWEEN AEROSURFACE SERVOAMPLIFIER 1 (ASA-1) AND THE RIGHT HAND INBOARD ELEVON ACTUATOR PRIMARY DELTA PRESSURE TRANSDUCER.</li> <li>- MDU CRT 4 REPORTED 'MSG COM 1553B ERROR', 'MESSAGE 1553B FAIL' AND 'MEDS I/O ERROR' IN DOWNLIST AT NOSE GEAR TOUCHDOWN.</li> </ul> <p><u>KSC:</u></p> <ul style="list-style-type: none"> <li>- Fondue-Fyre Liberated from SRB Main Flame Deflector, STS-125, Pad A</li> <li>- Brick Liberated from East Flame Trench Wall, SSME Side, STS-125, Pad A</li> </ul> <p><u>SRB:</u> None. <u>SSME:</u> None. <u>ET:</u> None. <u>MOD:</u> None.</p> <p><u>RSRM:</u></p> <ul style="list-style-type: none"> <li>- MISSING STIFFENER RING FOAM WITH DISCOLORATION, STIFFENER RINGS, RSRM-105B</li> </ul> <p><u>Integration:</u></p> <ul style="list-style-type: none"> <li>- Aerosurface Servo Amplifier-1 (ASA-1) Power Supply Failed</li> <li>- Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)</li> <li>- Ice Internal and External to the LH2 T-0 Umbilical</li> <li>- Gap Filler Releases From Port OMS Pod</li> </ul> <p><b>At Left: HUBBLE DETECTS - MOST ANCIENT OBJECT</b><br/>On Jan 26, 2011, NASA reported that Hubble using its new camera, discovered a faint red blob (see ultra-deep-field exposure insert above right) thought to be the most distant object ever seen: a small proto galaxy some 13.2 billion light years away (faint optical image in insert below right). This galaxy existed 480 million years after the "Big Bang". These exposures were taken in 2009 &amp; 2010. Credit NASA, ESA, G. Illingworth (U. of Calif Santa Cruz &amp; R. Bouwens (U. of Calif, Santa Cruz &amp; Leiden U.), &amp; HUDF09 Team.</p> |

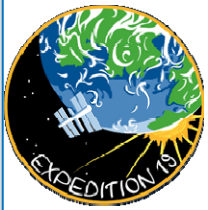
# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER   | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE ENG. S.N.   | SRB RSRM<br>AND ET   | ORBIT   |  | FSW   | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|---|---|---|--|---|--|---|--|---|--|---|
| STS-127/<br>ISS-2JA  | OV-105<br>(Flight 23)<br>ENDEAVOUR                | CDR:<br>Mark Polansky<br>(Flt 3 - STS-98, STS-116)<br>P794/R262/V185/M228   | KSC 39A<br>196:22:03:09Z<br>6:03:10 PM EDT (P)<br>6:03:10 PM EDT (A)<br>Wednesday (15)<br>07/15/09 (10)                               | KSC 15 (KSC 71)<br>212:14:48:07Z<br>09:48:07 AM CDT<br>Friday (15)<br>07/31/09 (12 )   | 104/104/109%<br><br><u>PREDICTED:</u><br>100/104.5/104.5/<br>72/104.5<br><br><u>ACTUAL:</u><br>100/104.5/100//<br>72/104.5<br><br>1 = 2045 (10)<br>2 = 2060 (1)<br>3 = 2054 (9)<br><br><u>M 3 EOM:</u><br><u>WEIGHT:</u><br>215899.5 LBS<br><u>X CG:</u><br>1089.8 IN<br><br><u>LANDING:</u><br><u>WEIGHT:</u><br>215816.5 LBS<br><u>X CG:</u><br>1091.7 IN | BI-138<br><br>RSRM<br>106<br><br>ET-131<br><br>SLWT<br>35<br><br><u>ET</u><br><u>IMPACT</u><br>1:14:27<br>MET<br><br><u>LAT:</u><br>35.889 S<br><br><u>LONG:</u><br>157.79 W | 51.6<br>(29)<br><br>DIRECT<br>INSERTION<br><br><u>POST OMS-2:</u><br>123.8x32.3 NM<br><br><u>DEORBIT:</u><br>HA 184.5 NM<br>HP 22.2 NM<br><br><u>ENTRY</u><br><u>VELOCITY:</u><br>25855 FPS<br><br><u>ENTRY</u><br><u>RANGE:</u><br>4334 NM | OI-33<br>(3)<br><br><u>CARGO:</u><br>36253LBS<br><br><u>PAYLOAD</u><br><u>CHARGEABLE:</u><br>24682 LBS<br><br><u>DEPLOYED:</u><br>24266 LBS<br><br><u>NON-DEPLOYED:</u><br>290 LBS<br><br><u>MIDDECK:</u><br>126 LBS<br><br><u>SHUTTLE</u><br><u>ACCUMULATED</u><br><u>WEIGHTS:</u><br><u>DEPLOYED:</u><br>1548698 LBS<br><br><u>NON-DEPLOYED:</u><br>1621661 LBS<br><br><u>CARGO TOTAL:</u><br>4090475 LBS<br><br><u>PERFORMANCE</u><br><u>MARGINS (LBS):</u><br>FPR: 2651<br>FUEL BIAS: 1059<br>FINAL TDDP: 2553<br>RECON:2734<br><br><u>PAYLOADS:</u><br><u>PLB:</u><br>ISS-2JA, ANDRE-2, DRAGONSAT<br><br><u>MIDDECK:</u><br>ISS-2A, MAUI, SEITE, SIMPLEX<br><br>5 CRYO TANK SETS<br>ODS, SRMS (84), OBSS, SSPTS, ECSHS(2), ROEU, PPSUS(2) | <i><b>Brief Mission Summary:</b> STS-127 ( 29th mission to ISS) was a "16 day marathon construction mission". The final pieces of the Japanese Kibo Complex including an Experiment Exposed Facility ("Porch in Space" - PAO) and the unpressurized Experiment Logistics Module were delivered along with spare equipment intended to keep ISS operational long after Shuttle is retired. Five EVA's and operations of three robotic arms were conducted for completion of all objectives.</i><br><br><b>KSC WD:</b><br>OPF: 109 + 9H<br>VAB: 7 + 0C<br>PAD B: 32 + 10C + 1 SD (STS-125 launch) + 1 CR (Crew Rest Day)<br>PAD A: 42 + 3C + 1H<br>Total Work Days = 190 (OPF processing occurred over a total time period of 118 days.)<br><br><b>POSTPONEMENTS:</b><br>- Added STS-127 to FDRD - launch date of 04/23/09 on 04/24/08.<br>- Ppd. to 05/15/09 on 07/03/08. Slip due to ET deliveries.<br>- Ppd. to 06/13/09 on 03/10/09. Slip due to interim changes while Cx and SSP schedules were assessed and prioritized.<br><br><b>LAUNCH SCRUBS:</b><br>- Launch scrubbed officially on Saturday, 06/13/09 at 12:26 a.m. EDT due to GH <sub>2</sub> leak at the GUCP – the same type of leak that scrubbed STS-119 in March. Launch rescheduled for 06/17/09. Technical Scrub.<br>- Launch scrubbed officially on Wednesday 06/17/09 at 1:55 EDT with the reoccurrence of the same type of GUCP leak as previous scrub. Launch rescheduled for 07/11/09. Technical Scrub.<br>- Launch officially scrubbed during L-11 Hour Hold at MMT meeting on Saturday morning, 07/11/09, due to unstable weather and lightning strikes overnight in KSC area. Seven strikes hit the lightning protection system, but none hit the vehicle. Launch rescheduled for 07/12/09. Weather Scrub.<br>- Launch scrubbed during a final hold at T-9 minute mark on Sunday 07/12/09 due to predicted thunderstorms within 20 nm limit of SLF. Launch rescheduled for 07/13/09. Weather Scrub.<br>- Launch scrubbed at 6:39 PM EDT on Monday 07/13/09 due to weather violations in KSC area. Launch rescheduled for 07/15/09. Weather Scrub.<br><br>Continued... |  |   |
| SEQ<br>FLT # 127   | <u>OMS PODS</u><br>LPO3 -33<br>RPO4 29<br>FRC5-22 | <u>PLT</u><br>Doug Hurley<br>P795/R341/M295   | <u>LAUNCH WINDOW:</u><br>10M 0S (Total)<br>5M 0S (Preferred)<br><br><u>EOM PLS:</u> KSC<br><br><u>TAL:</u> MRN<br><u>TAL WX:</u> ZZA. | <u>DEORBIT BURN:</u><br>212:13:41:09.9Z<br><br><u>XRANGE:</u> 672.5 NM<br><br><u>ORBIT DIR:</u> A/L (41)<br><br><u>AIM PT:</u> Nominal<br><br><u>MLGTD:</u> 1797 FT<br>212:14:48:07Z<br><u>VEL:</u> 208 KGS<br>209 KEAS<br><u>HDOT:</u> -2.8 FPS<br><br><u>TD NORM 195:</u><br>2865 FT<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u> 186 KEAS<br>212:14:48:13Z<br><br><u>NLGTD:</u> 5842 FT<br>212:14:48:19Z<br><u>VEL:</u> 152 KGS<br>150 KEAS<br><u>HDOT:</u> -5.0 FPS<br><br><u>BRK INIT:</u> 71 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u><br>56 KGS<br>12:14:48:52Z<br><br><u>BRK DECEL FPS<sup>2</sup>:</u><br>AVE 4.8 PK 6.3<br><br>Continued... |   |  |   |  |   |  |   |
| KSC-127  |   |   |   |  |   |  |   |  |   |  |   |
| PAD 39A<br>(50)  |   | <u>MS 1</u><br>Christopher Cassidy<br>P796/R342/M296  |   |  |   |  |   |  |   |  |   |
| MLP-3  |   | <u>MS 2</u><br>Julie Payette (Canada)<br>(Flt 2-STS-96)<br>P797/R249/V205/F33   |   |  |   |  |   |  |   |  |   |
| 29th<br>SHUTTLE<br>FLIGHT<br>TO ISS  |   | <u>MS 3</u><br>Tom Marshburn<br>P798/R343/M297  |   |  |   |  |   |  |   |  |   |
|   |   |   |   |  |   |  |   |  |   |  |   |
|  |   | <u>MS 4</u><br>Dave Wolf<br>(Flt 4 - STS-58, Up to Mir on STS-86, Dn on STS-89, STS-112)<br>P799/R173/V147/M151<br><br><u>MS 5 UP Stay ISS</u><br><u>EXP20/FLT ENG</u><br>T1m Kopra<br>P800/R344/M298<br><br>Continued... |   |  |   |  |   |  |   |  |   |
|  |   |   |   |  |   |  |   |  |   |  | <b>Gaseous hydrogen vent line leak caused STS-119 scrub in March 2009, also caused two scrubs on STS-127. This line connects the Ground Umbilical Carrier Plate (GUCP), attached to ET, to "flare stack" for burn-off of vented gaseous hydrogen.</b> |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT                                  | ORBITER | CREW<br>(6+1 UP/6+1 DN)   | LAUNCH SITE,<br>LIFTOFF TIME,  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE   | SSME-TL<br>NOM-ABORT<br>EMERG  | SRB<br>RSRM | ORBIT  |       | FSW   | PAYLOAD<br>WEIGHTS,  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,   |  |
|--------------------------------------|---------|---|--|--|--|-------------|--|-------|---|--|--|--|
| NO.                                  |         | TITLE, NAMES<br>& EVA'S   | LANDING SITES,<br>ABORT TIMES  | LANDING TIMES<br>FLT DURATION,<br>WINDS  | THROTTLE<br>PROFILE<br>ENG. S.N.   | AND<br>ET   | INC  | HA/HP |   | PAYLOADS/<br>EXPERIMENTS   | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |  |
| STS-127/<br>ISS-2JA<br>Continued ... |         | Continued...<br><br><u>MS 5 DN EXP 18/19/20</u><br><u>FLT ENG (Japan)</u><br>Koichi Wakata<br>(Flt 3 - STS-72, STS-92,<br>Up on STS-119 stay ISS)<br>P801/R208/V164/M181<br><br>SS EVA 137<br>DOCKED QUEST EVA 55<br>EMU/TETHERED EVA 130<br>SCHEDULED EVA 128<br>DURATION 5:32<br><br>SS EVA 138<br>DOCKED QUEST EVA 56<br>EMU/TETHERED EVA 131<br>SCHEDULED EVA 129<br>DURATION 6:53<br><br>SS EVA 139<br>DOCKED QUEST EVA 57<br>EMU/TETHERED EVA 132<br>SCHEDULED EVA 130<br>DURATIO N 5:59<br><br>SS EVA 140<br>DOCKED QUEST EVA 58<br>EMU/TETHERED EVA 133<br>SCHEDULED EVA 131<br>DURATIO N 7:12<br><br>SS EVA 141<br>DOCKED QUEST EVA 59<br>EMU/TETHERED EVA 134<br>SCHEDULED EVA 132<br>DURATION 4:54<br><br>Continued... | Continued...<br><br><u>SE TAL (ZZA 104):</u><br>6:03(P) 6:08(A)<br><br><u>PTM (U/S 181 FPS):</u><br>6:01(P) 6:14(A)<br><br><u>SE PRESS 104</u><br>6:52(P) 7:01(A)<br><br><u>MECO CMD:</u><br>8:22.4(P)<br>8:24.9(A)<br><br><u>VI:</u><br>25819(P) 25820(A)<br><br><u>OMS-2:</u><br>35:45 (P) 38:30(A)<br>98.7(P) 96.9(A) FPS | Continued...<br><br><u>WHEELS STOP:</u><br>212:14:49:13Z<br><br>11856 FT<br><br><u>ROLLOUT:</u><br>10059 FT<br><br>1:06 M:S<br><u>WINDS:</u><br>7H KT 6R KTS<br>OFFICIAL:<br>19008P13KT<br>(X5P7 H7P11)<br><br><u>DENS ALT:</u> 1916 FT<br><br><u>FLT DURATION:</u><br>15:16:44:58<br><u>S/I:</u><br>1212:01:31:44<br><br><u>OV-105:</u><br>266:15:33:01<br><br><u>DISTANCE:</u><br>6,547,853 sm<br><br><u>TOTAL SHUTTLE<br/>DISTANCE:</u><br>497,402,218 sm |  |             | JSC2009-E-143033 --- Retired NASA Launch Director Robert Sieck, right, talks with Associate Administrator for Space Operations Bill Gerstenmaier in KSC Firing Room during a built-in launch countdown hold. |       |  |  | ISS020-E-022626 (20 July 2009) --- Endeavour's crew cabin, along with the ISS's Kibo laboratory and Harmony node are shown during 2nd EVA. |  |
|                                      |         |   |  |  |  |             |  |       |   | Continued...<br><br><u>LAUNCH WINDOW:</u> Total launch window was 10M 5S with window open at 196:21:58:10Z and close at 196:22:08:10Z. Preferred Launch Time was 196:22:03:10Z (In-Plane Time) for a launch window of 5M 0S.<br><br><u>LAUNCH DELAYS:</u><br>- None. Launch occurred on time at 196:22:03:10Z, 6:03:10 p.m. EDT, Wednesday, July 15, 2009. The Spaceflight Meteorology Group (SMG) forecast was challenged by thunderstorms along the east coast breeze throughout the day. However, the weather improved at the SLF and within the 20nm limit prior to launch for a "Go".<br><br><u>TAL WEATHER:</u> TAL weather also cooperated for a Go for launch. A high pressure system produced dry and stable conditions across southern Spain. The two Spanish TAL sites were forecast for clear skies and winds within flight rule limits. Istres was forecasting a slight chance of a ceiling below flight rule limits for launch day.<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: 1) PE Operational High Q SUM/JUL, 2) OMS Assist, 3) a 52 nautical mile MECO, and 4) Del Psi<br><br><u>FLIGHT DURATION CHANGES:</u> NONE<br>- Planned landing at KSC on orbit 248. Landed at KSC Runway 15 on orbit 248 at 212:14:48:07Z on Friday, July 31, 2009.<br><br><u>FIRSTS/SECONDS/LASTS:</u><br>- Five launch scrubs is second highest number: STS-73 in 1995 & STS-61C in 1986 had six.<br>- Koichi Wakata, first Japanese astronaut to have engaged in long-duration on-orbit, returned to Earth after 4 1/2 months.<br>- First flight of SSME controller constant updates, an updated MPS propellant inventory, and an updated CMR.<br>- Record-size space crew of thirteen (ISS & Shuttle).<br><br><u>NIGHT LAUNCH:</u> N/A<br><br><u>RENDEZVOUS:</u> #74 Rendezvous and dock with ISS.<br><br>Continued... |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT                                  | ORBITER | CREW<br>(6+1 UP/6+1 DN)   | LAUNCH SITE,<br>LIFTOFF TIME, | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE  | SSME-TL<br>NOM-ABORT<br>EMERG    | SRB<br>RSRM | ORBIT |       | FSW | PAYLOAD<br>WEIGHTS,      | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,  |
|--------------------------------------|---------|---|-------------------------------|---|----------------------------------|-------------|-------|-------|-----|--------------------------|---|
| NO.                                  |         | TITLE, NAMES<br>& EVA'S   | LANDING SITES,<br>ABORT TIMES | LANDING TIMES<br>FLT DURATION,<br>WINDS | THROTTLE<br>PROFILE<br>ENG. S.N. | AND<br>ET   | INC   | HA/HP |     | PAYLOADS/<br>EXPERIMENTS | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
| STS-127/<br>ISS-2JA<br>Continued ... |         | <p>Continued...</p> <p>MCC WHITE FLIGHT<br/>FCR (57)</p> <p><u>FLIGHT DIRECTORS:</u><br/><u>SHUTTLE:</u><br/>A/E- Bryan Lunney<br/>LD/O1- Paul Dye<br/>O2- Kwatsi Alibaruho<br/>Planning- Gary Horlacher<br/>- Mike Sarafin<br/>MOD – John McCullough<br/>Team 4- Richard Jones</p> <p><u>ISS</u><br/>O1 - Brian Smith<br/>LD/O2 – Holly Ridings<br/>O3 – Derek Hassmann<br/>Team 4 - Ron Spencer</p> <p><u>CAPCOMS:</u><br/><u>SHUTTLE</u><br/>A/E – Alan Poindexter<br/>- Eric Boe (Wx)<br/>LD/O1 – Greg (Box) Johnson<br/>O2 - Janice Voss<br/>Planning - Stan Love<br/>- Shannon Lucid<br/>Team 4 - N/A</p> <p><u>ISS</u><br/>O1 – Hal Getzelman<br/>LD/O2-Akihiko Hoshide<br/>O3 – Jason hutt<br/>Team 4 – N/A</p> |                               |   |                                  |             |       |       |     |                          | <p>Continued...</p> <p><b>EVENTS:</b></p> <ul style="list-style-type: none"> <li>- During liftoff several pieces of foam insulation came off the ET. Shuttle was hit two or three times, said Bill Gerstenmaier. Some scuff marks were spotted on the belly, but that probably is coating loss and considered minor, he said. That was later determined to be the case.</li> <li>- FD1: OMS2 ignition at 196:22:41:40.0.9Z resulted in a 125.4 by 85.1 NM orbit.</li> <li>- FD2: RCC inspection found no areas of concern</li> <li>- T1 maneuver at 198:15:17:25.9Z resulted in a 188.7 by 184.0 NM orbit</li> <li>- FD3: R-Bar Pitch Maneuver was performed. No issues.</li> <li>- Hard Dock, hooks closed, occurred at 198:15:47:10Z (12:47 CDT, July 17, 2009)</li> <li>- ISS Hatch opened at 198:17:48:10Z (2:48 PM CDT, July 17, 2009) welcomed by ISS crew.</li> <li>- IELK Seat Liner Transfer at 198:19:22:10Z (9:00 PM CDT March 17, 2009). At that time Koichi Wakata became a member of STS-127 and Tim Kopra joined the ISS Expedition 20 as Flight Engineer.</li> <li>- Reboost - ~2.5 fps posigrade delta V. Increased altitude approx 4700 ft. Cleared vehicles of conjunction with Object 84180.</li> <li>- FD4: Based on review of launch imagery, MMT cancelled FD5 focused inspection of Orbiter heat shield.</li> <li>- FD4: EVA 1: David Wolf &amp; Tim Kopra: Activities included: JPM berthing mechanism prep and install, CETA cart mods, and the P3 Nadir UCCAS deploy. EVA was shortened due to suit consumables. The PAS deploy was ppd. EVA1 duration 5:32.</li> <li>- Using the SSRMS and SRMS the JEM Exposed Facility (JEF) was successfully unberthed from the Shuttle P/B and captured on the Japanese Experiment Module (JEM).</li> <li>- FD6: EVA2: Dave Wolf &amp; Tom Marshburn: Activities included: Transfer of ORU's (Space-to-Ground Antenna, Linear drive Unit &amp; Pump Module) from the Integrated Cargo Carrier (ICC) to the External Stowage Platform. Installation of the JEF forward Vision Equipment [VE] was deferred. EVA2 duration 6:53.</li> <li>- FD8: EVA3: Dave Wolf &amp; Chris Cassidy: Activities included: Node 2 WIF 14 removal and installation to COL WIF 2, JLE payload prep, completion of 2 Lab FPP grounding sleeves, changeput of 2 of 6 batteries on P6 (batts A &amp; B from the ICC-VLD) and positioning of ICC-VLD in overnight parking configuration. EV2's LiOH performance caused early termination. EVA3 duration 5:59.</li> <li>- FD10: EVA4: Chris Cassidy &amp; Tom Marshburn: Activities included: successful R&amp;R of all batteries and successful latching of the ICC-VLD back into the Shuttle P/L bay for return. EVA4 duration 7:12.</li> </ul> <p>Continued...</p> |



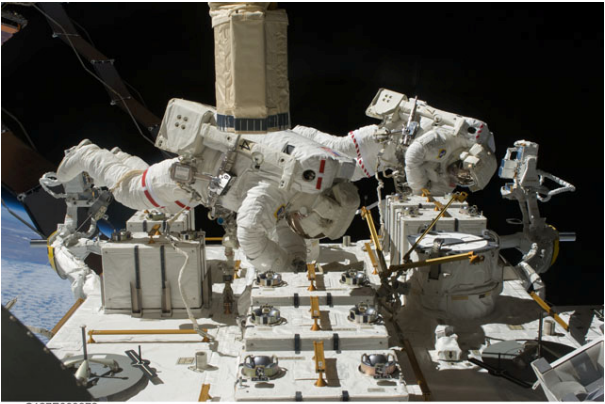


S127E009733


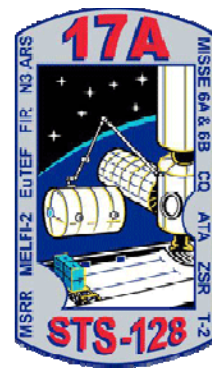

**S127-E-009733 (28 July 2009) --- Record Size Space Crew:**  
The STS-127 and Expedition 20 crew members pose for a group portrait in ISS Harmony Node. From left (front row) are NASA astronauts Michael Barratt, Exp 20 FE; Mark Polansky, STS-127 CDR; cosmonaut Gennady Padalka, Exp 20 CDR; and NASA astronaut Dave Wolf, STS-127 MS. From left (middle row) are JAXA astronaut Koichi Wakata, STS-127 MS; Canadian astronauts Julie Payette, STS-127 MS and Robert Thirsk, Exp 20 FE; and NASA astronaut Tom Marshburn, STS-127 MS. From left (back row) are cosmonaut Roman Romanenko, Exp 20 FE; NASA astronauts Christopher Cassidy, STS-127 MS; Doug Hurley, STS-127 Pilot; Tim Kopra, Exp 20 FE; and ESA astronaut Frank De Winne, Exp 20 FE.



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME,  | LANDING SITE/ RUNWAY, CROSSRANGE | SSME-TL NOM-ABORT EMERG | SRB RSRM   | ORBIT INC | HA/HP | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|--|---|----------------------------------|-------------------------|--|-----------|-------|-----|--|---|
| STS-127/ISS-2JA<br>Continued ...   |         |  |   |                                  |                         |  |           |       |     |  |   |
|  <p>JSC2009-E-145586 --- Orbit 1 Lead FD Paul Dye (foreground) on console during docking of STS-127 Endeavour to ISS. In background are CAPCOM's Dominic Gorie (far left) and Greg Johnson.</p>  |         |  |  <p>S127E-011200 (28 July 2009) --- The ISS is seen from Space Shuttle Endeavour as the two spacecraft begin their relative separation.</p>   |                                  |                         | <p><b>EVENTS:</b> Continued...</p> <ul style="list-style-type: none"> <li>- FD13: EVA5: Chris Cassidy &amp; Tom Marshburn: Activities included: completion of Z1 patch panel reconfig, SPDMM covers, JEF Vision Equipment installation and several get-aheads (JEM handrail and WIF installation, Lab cable tiedowns, Node 2 Gap Spanner installation, and relocating two APFR's for STS-128). The S3 Zenith Outboard PAS task was not performed due to lack of time based on predicted METOX capability. EVA5 duration 4:54.</li> <li>-Transfers: <ul style="list-style-type: none"> <li>24,638 Pounds of hardware transferred to ISS (inside &amp; out)</li> <li>10,479 Pounds of hardware returned aboard Endeavour</li> <li>2,175 Pounds of middeck items delivered to ISS aboard Endeavour</li> <li>1,980 Pounds of middeck items returned from ISS to Endeavour</li> <li>1,225 Pounds of water transferred to ISS</li> <li>45 Pounds of Oxygen used for "stack maintenance"</li> <li>12 Pounds of Nitrogen transferred to ISS</li> </ul> </li> <li>- ISS Mass in space 685,986 mass - pounds</li> <li>- FD14: Undocked at 209:17:26:00Z (12:26 PM CDT, July 28, 2009)</li> <li>- After undocking, Hurley initiated Endeavour fly-around at a distance of 400 feet from ISS and completed Sep-maneuver at 209:19:09:00Z (2:09 PM CDT, July 28, 2009)</li> <li>- During Entry comm blackout occurred at 212:14:34:05Z - 212:14:36:24Z due to plasma effect.</li> </ul> |           |       |     |  |   |
| <p>BELOW: S127-E-009372 (27 July 2009) Marshburn (left) &amp; Cassidy, STS-127 MS's, participate in fifth and final EVA as construction and maintenance continue on the ISS.</p>  <p>S127E009372</p>   |         |  | <p><b>SIGNIFICANT ANOMALIES:</b> Continued...</p> <p><u>ET:</u></p> <ul style="list-style-type: none"> <li>- POST-LAUNCH CAMERA AND FILM REVIEW SHOWED LOSS OF FOAM AT SEVERAL LOCATIONS ON THE INTERTANK.</li> <li>- POST-LAUNCH CAMERA &amp; FILM REVIEW SHOWED LOSS OF FOAM IN THE AFT INBOARD CORNER OF THE LO<sub>2</sub> ICE FROST RAMP AT STATION 718</li> <li>- ET TPS Loss Outboard Section of the -Y Bipod Closeout</li> </ul> <p><u>MOD:</u> None.</p> <p><u>Integration:</u></p> <ul style="list-style-type: none"> <li>- Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)</li> <li>- LH<sub>2</sub> Leak at ET Ground Umbilical Carrier Plate (GUCP)</li> <li>- Ice Internal and External to the LH<sub>2</sub> T-0 Umbilical</li> </ul> |                                  |                         |  |           |       |     |  |   |
| <p><b>SIGNIFICANT ANOMALIES:</b></p> <p><u>Orbiter:</u></p> <ul style="list-style-type: none"> <li>- MICROBIAL REMOVAL ASSEMBLY LEAKAGE</li> <li>- FUEL CELL 3 SN 121 SUSTAINING HEATER TURNED ON WHEN THE FC STACK OUT TEMPERATURE REACHED A VALUE OF 185 DEG F</li> <li>- DURING THE RCS HOTFIRE TEST, FORWARD RCS THRUSTER F2F EXHIBITED LOW PC (V42P1542A) OF APPROXIMATELY 16 PSI. F2F WAS DECLARED FAILED OFF AND AUTO DESELECTED BY RCS RM AT MET 14/10:45:40 (GMT 211/08:48:50).</li> </ul> <p><u>KSC:</u></p> <ul style="list-style-type: none"> <li>- The Istres Backup Azimuth system is in a Hard Overscan Alarm</li> <li>- STS-127 Post Launch Debris</li> </ul> <p><u>SRB:</u></p> <ul style="list-style-type: none"> <li>- TOP LAYERS OF MSFC CONVERGENT COATING (MCC-1) MISSING ON AFT SKIRT TPS ACREAGE (BOTH LEFT &amp; RIGHT HAND)POST FLIGHT OF STS-127/BI-138</li> <li>- LEFT-HAND SOLID ROCKET BOOSTER ENHANCED DATA ACQUISITION SYSTEM (EDAS) ASSEMBLY CHANNEL 4 DID NOT RECORD NOMINAL STRAIN RESPONSE.</li> </ul> <p><u>RSRM:</u> None.</p> <p><u>SSME:</u> None.</p> <p>Continued at left...</p> |         |  |   |                                  |                         |  |           |       |     |  |   |

## Page 2-213 -STS-128/17A




| FLT NO.  | ORBITER   | CREW<br>(6+1 UP/6+1 DN)  | LAUNCH SITE,<br>LIFTOFF TIME,  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE   | SME-TL<br>NOM-ABORT<br>EMERG  | SRB<br>RSRM   | ORBIT        |  | FSW          | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|---|--|--|--|---|---|--------------|--|--------------|---|---|
|  |   | TITLE, NAMES<br>& EVA'S  | LANDING SITES,<br>ABORT TIMES  | LANDING TIMES<br>FLT DURATION,<br>WINDS  | THROTTLE<br>PROFILE<br>ENG. S.N.  | AND<br>ET   | INC          | HA/HP  |              |   |   |
| STS-128<br>(17A)<br><br>SEQ<br>FLT # 128<br><br>KSC-128<br><br>PAD 39A<br>(51)<br><br>MLP-2<br><br>30 <sup>th</sup><br>SHUTTLE<br>FLIGHT<br>TO ISS | OV-103<br>(Flight 37)<br>DISCOVERY<br><br><u>OMS PODS</u><br>LPO1 -40<br>RPO3-38<br>FRC3-37 | CDR:<br>Rick Sturckow<br>(Flt 4 - STS-88, STS-105<br>STS-117)<br>P802/R247/V173/M215<br><br><u>PLT</u><br>Kevin Ford<br>P803/R345/M259<br><br><u>MS 1</u><br>Patrick Forrester<br>(Flt 3 - STS-105, STS-117)<br>P804/R269/V186/M235<br><br><u>MS 2</u><br>Jose Hernandez<br>P805/R346/M300<br><br><u>MS 3</u><br>Danny Olivas<br>(Flt 2-STS-117)<br>P806/R309/V207 /M267<br><br><u>MS 4</u><br>Christer Fuglesang (ESA)<br>(Flt 2 - STS-116)<br>P807/R304/V208/M264<br><br><u>MS 5 UP Stay ISS</u><br><u>EXP20/FLT ENG</u><br>Nicole Stott<br>P808/R347/F47<br><br><u>MS 5 DN EXP 20</u><br><u>FLT ENG</u><br>Tim Kopra<br>Up on STS-127 stay ISS)<br>P809/R344/M298 | KSC 39A<br>241:03:59:37Z<br>11:59:37 PM EDT (P)<br>11:59:37 PM EDT (A)<br>Friday (27)<br>08/28/09 (9)<br><br><u>LAUNCH WINDOW:</u><br>9M 36S (Total)<br>4M 48S (Preferred)<br><br><u>EOM PLS:</u> KSC<br><u>TAL:</u> MRN<br><u>TAL WX:</u><br>FMI.(NO GO)<br>ZZA (NO GO)<br><br><u>SELECTED:</u><br><u>RTL:</u> KSC33 N/N<br><u>TAL:</u> MRN20 N/N<br><u>AOA:</u> NOR 17 N/SFD<br>S B<br><u>1<sup>ST</sup> DAY PLS:</u> EDW<br>22L N/SFD<br><br><u>TD EL:</u><br>0.000 (P) -0.078 (A)<br><br><u>MAX Q NAV:</u><br>752.76 (P) 738.70<br>(A)<br><br><u>SRB STG:</u><br>2:02.2 (P) 2:02.6 (A)<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (MRN):</u><br>2:38 (P) 2:41 (A)<br><br><u>NEG MRN (2@ 104):</u><br>3:52 (P) 3:53(A)<br><br><u>PTA (U/S 157 FPS):</u><br>5:09(P) 5:12(A) | EDW22 CONC<br>EDW 54 CONC 35<br>255:00:53:20Z<br>7:53:20 PM CDT<br>Friday (16)<br>09/11/09 (12)<br><br><u>DEORBIT BURN:</u><br>254:23:47:37Z<br><br><u>XRANGE:</u> 374.6NM<br><br><u>ORBIT DIR:</u> A/L (42)<br><br><u>AIM PT:</u> Nominal<br><br><u>MLGTD:</u> 1515 FT<br><br>255:00:53:20Z<br>VEL: 220 KGS<br>199 KEAS<br>HDOT: -4.3 FPS<br><br><u>TD NORM 195:</u><br>1753 FT<br><br><u>DRAW CHUTE</u><br><u>DEPLOY:</u> 155 KEAS<br>255:00:53:32Z<br><br><u>NLGTD:</u> 4854 FT<br>255:00:53:29Z<br>VEL: 185 KGS<br>161 KEAS<br>HDOT: -6.3 FPS<br><br><u>BRK INIT:</u> 113 KGS<br><br><u>DRAW CHUTE</u><br><u>JETTISON:</u><br>54 KGS<br>255:00:54:06Z<br><br><u>BRK DECEL FPS:</u><br>AVE 4.8 PK 7.4 | 104/104/<br>109%<br><br><u>PREDICTED:</u><br>100/104.5/104.5/<br>72/104.5<br><br><u>ACTUAL:</u><br>100/104.5/100//<br>72/104.5<br><br>1 = 2052 (8)<br>2 = 2051 (9)<br>3 = 2047 (13)<br><br><u>M 3 EOM:</u><br>WEIGHT:<br>222200 LBS<br>X CG:<br>1088.4 IN<br><br><u>LANDING:</u><br>WEIGHT:<br>222271 LBS<br>X CG:<br>1090 IN | BI-139<br><br>RSRM<br>107<br><br>ET-132<br><br>SLWT 36<br><br><u>ET</u><br><u>IMPACT</u><br>1:14:26<br>MET<br><br><u>LAT:</u><br>35.875 S<br><br><u>LONG:</u><br>157.761<br>W | 51.6<br>(30) | DIRECT<br>INSERTION<br><br><u>POST OMS-2</u><br>T27.5x84.4 NM<br><br><u>DEORBIT:</u><br>HA 192.1 NM<br>HP 22.5 NM<br><br><u>ENTRY</u><br><u>VELOCITY:</u><br>25863 FPS<br><br><u>ENTRY</u><br><u>RANGE:</u><br>4399.1 NM | OI-34<br>(1) | <u>CARGO:</u><br>40605LBS<br><br><u>PAYLOAD</u><br><u>CHARGEABLE:</u><br>33056 LBS<br><br><u>DEPLOYED:</u><br>30572 LBS<br><br><u>NON-DEPLOYED:</u><br>2331 LBS<br><br><u>MIDDECK:</u><br>153 LBS<br><br><u>SHUTTLE</u><br><u>ACCUMULATED</u><br><u>WEIGHTS:</u><br><u>DEPLOYED:</u><br>1579270 LBS<br><br><u>NON-DEPLOYED:</u><br>1623992 LBS<br><br><u>CARGO TOTAL:</u><br>4131080 LBS<br><br><u>PERFORMANCE</u><br><u>MARGINS (LBS):</u><br>FPR: 2908<br>FUEL BIAS: 1059<br>FINAL TDDP: 1707<br>RECON: 2077<br><br><u>PAYLOADS:</u><br><u>PLB:</u><br>ISS-17A<br>(MPLM,LMC),<br>MISSE 6, TRIDAR<br>AR&D<br>SENSOR,DTO-<br>701A | <b>Brief Mission Summary:</b> The STS-128 (30th mission to ISS), dubbed "Racking Up New Science" by PAO, main objective was to deliver science and environmental racks to dramatically enhance the scientific capability of the ISS. These racks were carried in the Leonardo MPLM. Included in the cargo was the highly publicized Combined Operational Load Bearing External Resistance Treadmill (COLBERT) named after TV comedian Stephen Colbert. Three EVA's were conducted and included replacement of the massive ammonia tank used by the ISS Thermal Control System.<br><br><u>KSC W/D</u><br>OPF: 117+ 2H<br>VAB: 9 + 0C<br>PAD A: 25 + 0C<br>Total Work Days = 151 (OPF processing occurred over a total time period of 119 days.)<br><br><u>POSTPONEMENTS:</u><br>- Added STS-128 to FDRD - launch date of 07/30/09 on 06/23/08.<br>- Ppd. to 08/06/09 on 12/10/08. Interim manifest while HST final placement is considered.<br>- Ppd. to 08/07/09 on 06/08/09. Slip due to MA direction.<br>- Ppd. to 08/18/09 on 06/30/09. Slip due to STS-127 GUCP delays.<br>- Ppd. to 08/25/09 on 08/20/09. Slipped to support KSC processing.<br><br><u>LAUNCH SCRUBS:</u><br>- 08/25/09 weather did not cooperate, systems looked good. Setting up for the next opportunity, window open at 12:05am CDT tomorrow with the in-plane time at 12:10am. Weather Scrub.<br>- 08/25/09 the 2nd launch attempt was scrubbed officially at 4:52 p.m. CDT (5:52 Eastern) by Launch Director Pete Nickolenko due to stuck "fill & drain valve during ET loading. Based on the results of a technical review of the MPS Hydrogen Fill & Drain Valve data, a 48 hour scrub turnaround was initiated. Technical scrub.<br>- 08/27/09 Official no go for launch today. Launch postponed to allow engineers additional time to develop flight rationale based on testing of F&D valve. Moses, "Will try tomorrow night if we get there." Next opportunity is Friday at 10:59 pm CDT (11:59 Eastern).<br>- 08/28/09 MMT Summary at 12:55 PM: Reviewed LH2 valve (PV12) and agreed to plan for tonight's launch attempt. MMT is go to proceed for launch. |
|   |   |  |  |  |   |   |              |  |              |   |   |
|    |   |  |  |  |   |   |              |  |              |   |   |
| Continued...   |   |  |  |  |   |   |              |  | Continued... |   |   |
| <div style="float: right;">  </div>                            |   |  |  |  |   |   |              |  |              |   |   |



## Page 2-214 - STS-128/17A




[illegible]

# SPACE SHUTTLE MISSIONS SUMMARY




| FLT NO.   | ORBITER | CREW (6+1 UP/6+1 DN)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES                      | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N.  | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---------|---|--|---|---|--------------------|--------------------|-----|--|--|
| STS-128 (17A)<br><br>Continued...   |         | Continued...<br><u>CAPCOMS:</u><br><u>SHUTTLE</u><br>A/E – Eric Boe<br>- Chris Ferguson (Wx)<br>LD/O1 - Chris Ferguson<br>- Tony Antonelli<br>O2 - Stan Love<br>Planning - Shannon Lucid<br>Team 4 - N/A<br><br><u>ISS</u><br>O1 - Chris Zajac<br>LD/O2 - Robert Hanley<br>O3 – Mike Jensen<br>Team 4 – N/A | Continued...<br><u>OMS-2:</u><br>39:00 (P) 39:00(A)<br>95.1(P) 94.5(A) FPS | Continued...<br><u>WHEELS STOP:</u><br>255:00:54:33Z<br>13109 FT<br><br><u>ROLLOUT:</u><br>11594 FT<br>1:13 M:S<br><u>WINDS:</u><br>-6.5T KT<br>-2.5L KTS<br><u>OFFICIAL:</u><br>09007P08KT<br>(X4P4 T6P7)<br><br><u>DENS ALT:</u><br>5489 FT<br><br><u>FLT DURATION:</u><br>13:20:53:43<br><u>S/T:</u><br>1225:22:25:27<br><br><u>OV-103:</u><br>332:00:33:34:<br><br><u>DISTANCE:</u><br>5,702,716 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>503,104,934 sm | <br>S128E007229   |                    |                    |     |  | Continued...<br><u>RENDEZVOUS: #75</u> Rendezvous and dock with ISS.<br><br><u>EVENTS:</u><br>- FD1: OMS2 ignition at 241:04:38:36.9Z resulted in a 127.5 by 84.4 nm orbit.<br>- FD2: RCC inspection found no areas of concern<br>- T1 maneuver at 242:22:26:17Z resulted in a 193.2 by 181.6 NM orbit<br>- FD3: R-Bar Pitch Maneuver was performed. No issues.<br>- Docking Contact occurred at 243:00:53:56Z<br>- Hard Dock, hooks closed, occurred at 243:01:07:23Z<br>- ISS Hatch opened at (9:32 PM CDT, Aug 30, 2009) welcomed by ISS crew.<br>- IELK Seat Liner Transfer at (10:50 PM CDT, Aug 30). At that time Tim Kopra became a member of STS-128 and Nicole Stott joined ISS EXP 20.<br>- MMT FD3 reported VRCS jet F5R experienced a jet fail leak at 00/4:37 MET. ISS to perform all attitude control & maneuvers during the docked mission.<br>- MMT FD5 concurred that no Focused Inspection of Orbiter was required.<br>- FD5: "Leonardo" MPLM transferred to ISS, Zero-G stowage rack to "Harmony" node & COLBERT treadmill transferred.<br>- EVA 1: Olivas & Stott successfully completed: Prep of P1 truss Ammonia Tank Assembly (ATA) for removal, EuTEF & MISSE experiment removal from Columbus module. EVA1 duration 6:35.<br>- FD7: EVA2: Olivas & Fuglesang: EVA was about 51 min late due to Olivas' comm. cap chin strap came undone while in pre-breathe. The ATA task was completed early & 3 get ahead tasks were completed: CLA cover installation, APFR 4 tool stanchion relocation, & CLPA cover installation. EVA2 duration 6:39.<br>- FD9: EVA3: Olivas & Fuglesang: Activities included: Deploy S3 Truss Payload Attach System, Rate Gyro Assembly 2 R&R, S0 Truss Remote Power Control Unit R&R, Global Positioning System 4 installation, "Tranquility" Node 3 avionics cable routing (full), & Oxygen Generator Assembly water filter R&R. A lens became mechanically detached from Fuglesang's helmet at the end of the EVA. Without intact helmet lights he headed to the A/L before sunset. His PET was 6:22. Olivas performed cleanup. EVA3 duration (PET) 7:01.<br><br>Continued... |
|  <p>In the JSC MCC: JSC2009-E-155032 --- FDs Richard Jones (left) &amp; Tony Ceccacci on console during 2nd launch attempt. The launch was later postponed due to a valve issue in Discovery's main propulsion system. FD Bryan Lunney is in the background.</p> |         |   |  |   |   |                    |                    |     |  |  |
|   |         |   |  |   | <p>Construction and maintenance continued on the ISS.</p> <p>ABOVE: S128-E-007229 (1 Sept. 2009) --- Nicole Stott/EXP 20 FE, during EVA 1 with Danny Olivas/MS3 (out of frame). Activities included removal of an empty ammonia tank from ISS truss.</p> <p>BELOW: S128-E-007720 (5 Sept. 2009) --- Olivas/MS3 (left) &amp; Christer Fuglesang//ESA/MS4, participate in EVA3 activities.</p> <br>S128E007720 |                    |                    |     |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (6+1 UP/6+1 DN)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N. | SRB RSRM AND ET | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|--|---|--|--|-----------------|-------|--|-----|---|---|
| STS-128 (17A)   |         |  |   | S128-E-009998 (8 Sept. 2009) --- Back-dropped by Earth's horizon and the blackness of space, ISS as seen from Discovery as the two spacecraft begin their relative separation. |  |                 |       |  |     | Continued...  |   |
| Continued...  |         |  |   | <br>S128E009988  |  |                 |       |  |     | <ul style="list-style-type: none"><li>- Transfers:<ul style="list-style-type: none"><li>18,548 Lbs of hardware transferred to ISS</li><li>1,705 Lbs "New" ATA ( with 600 lbs of ammonia) to ISS</li><li>1,295 "Old" ATA to Discovery</li><li>5,223 Lbs hardware returned to Discovery</li><li>1,705 Lbs of middeck items transferred to ISS</li><li>861 Lbs of middeck items returned from ISS to Discovery</li><li>1,243 Lbs of water transferred to ISS</li><li>710,966 Mass in space of the ISS (lbs)</li><li>84 Percentage complete of ISS assembly</li></ul></li><li>- FD12: Undocked at 251:19:26:22Z</li><li>- During Entry comm blackout occurred at 255:00:38:39Z - 255:00:39:02Z due to plasma effect.</li><li>- FD15: Deorbit burn on orbit 219 for EDW landing.</li></ul> <p><b>SIGNIFICANT ANOMALIES:</b></p> <p><u>Orbiter:</u></p> <ul style="list-style-type: none"><li>- EV2 UNACCEPTABLE COMM DURING EVA 2.</li><li>- Vernier Thruster F5R Indicates Leak In Flight</li><li>- APU 3 EGT 2 R&amp;R</li><li>- Vernier Thruster F5R Indicates Leak In Flight</li></ul> <p><u>KSC:</u></p> <ul style="list-style-type: none"><li>- HANDLES ON BULK HEAD PLATES ARE LIBERATING</li><li>- STS-128 Post Launch Debris</li></ul> <p><u>SRB:</u></p> <ul style="list-style-type: none"><li>- DEBRIS OBSERVED NEAR HOLD DOWN POST (HDP-4) DURING ASCENT.</li><li>- RH MAIN CHUTE CANOPY DAMAGED WITH A VERTICAL TEAR EXTENDING FROM THE TOP VENT BAND TO THE CANOPY BOTTOM SKIRT BAND DURING STS-128 ON BI-139</li></ul> <p><u>RSRM:</u> None.</p> <p><u>SSME:</u> None.</p> <p><u>ET:</u></p> <ul style="list-style-type: none"><li>- STS-128/ET-132 REVIEW SHOWED FOAM LOSS BETWEEN +Y JACKPAD/Y BIPOD CLOSEOUTS AT LH2/IT FLANGE</li></ul> <p><u>MOD:</u> None.</p> <p><u>Integration:</u></p> <ul style="list-style-type: none"><li>- LH2 PV-12 Inboard Fill and Drain valve did not indicate closed when commanded</li><li>- Debris Observed Near RH SRB Aft Skirt HDP #4 Foot</li><li>- LH2 PV-12 Inboard Fill and Drain valve did not indicate closed when commanded</li></ul> |   |
| <br>ISS020E038322  |         |  |   | STS128-S-047 (11 Sept. 2009) --- Shuttle Discovery's main landing gear touchdown at EAFB. Landing was diverted from KSC due to marginal weather.                               |  |                 |       |  |     |    |   |
| ISS020-E-038322 --- STS-128 & Exp 20 crew in-flight portrait on ISS. STS-128 red-clad crew are: front row, from left, CDR Sturckow, Hernandez, & Forrester; middle row in red, PLT Ford, Olivas, & Fuglesang (ESA). EXP 20 crew (in blue) are: bottom left, Kopra, who joined ISS crew in July, now scheduled to return to Earth with STS-128. Clockwise from him are: Stott, Robert Thirsk/CSA, Roman Romanenko/RSA, Frank De Winne/ESA, Gennady Padalka/RSA, and Michael Barratt. |         |  |   |  |  |                 |       |  |     |   |   |




## Page 2-217 - STS-129/ULF3

| FLT  | ORBITER                           | CREW<br>(6 UP/6+1 DN)   | LAUNCH SITE,<br>LIFTOFF TIME,  | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE   | SSME-TL<br>NOM-ABORT<br>EMERG   | SRB<br>RSRM  | ORBIT        |   | FSW          | PAYLOAD<br>WEIGHTS,   | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,   |  |  |
|--|-----------------------------------|---|--|--|---|--|--------------|---|--------------|---|--|--|--|
| NO.  |                                   | TITLE, NAMES<br>& EVA'S   | LANDING SITES,<br>ABORT TIMES  | LANDING TIMES<br>FLT DURATION,<br>WINDS  | THROTTLE<br>PROFILE<br>ENG. S.N.  | AND<br>ET  | INC          | HA/HP   |              | PAYLOADS/<br>EXPERIMENTS  | TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |  |  |
| STS-129/<br>ULF3   | OV-104<br>(Flight 31)<br>ATLANTIS | CDR:<br>Charles O. Hobaugh<br>(Flt 3 - STS-104, STS-118)<br>P810/R268/V188/M234   | KSC 39A<br>320:19:28:10Z<br>1:28:01 PM CST (P)<br>2:28:01 PM EST (A)<br>Monday (15)<br>11/16/09 (15)   | KSC 33 KSC (72)<br>331 / 14:44:21Z<br>8:44:21 AM CST<br>Saturday (24)<br>11/7/09 (14 )<br><br>DEORBIT BURN:<br>331:13:37:09Z   | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/104.5/<br>72/104.5<br><br>ACTUAL:<br>100/104.5/100/<br>72/104.5 | BI-140<br><br>RSRM<br>108<br><br>ET-133<br>SLWT<br>37<br><br>ET<br>IMPACT<br>1:14:13<br>MET<br><br>LAT:<br>36.434 S<br><br>LONG:<br>158.531<br>W | 51.6<br>(31) | DIRECT<br>INSERTION<br><br><br><br><br>DEORBIT<br>HA 191.9 NM<br>HP 23.3 NM<br><br>ENTRY<br>VELOCITY:<br>25867 FPS<br><br>ENTRY<br>RANGE:<br>4390.31 NM | 01:34<br>(2) | CARGO:<br>38893LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>29372 LBS<br><br>DEPLOYED:<br>27615 LBS<br><br>NON-DEPLOYED:<br>1404 LBS<br><br>MIDDECK:<br>353 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1606885 LBS<br>NON-DEPLOYED:<br>1625396 LBS<br><br>CARGO TOTAL:<br>4131080 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 2908<br>FUEL BIAS: 1059<br>FINAL TDDP: 2228<br>RECON: 2041<br><br>PAYLOADS:<br>PLB:<br>ISS-ULF3 (ELC 1,<br>ELC 2, SASA,<br>MISSE 7A,<br>MISSE 7B)<br><br>Continued... | <b>Brief Mission Summary:</b> The STS-129 (31th mission to ISS), dubbed "Stocking the Station" by PAO, main objective was to deliver nearly 14 tons of ISS systems spares. The most critical spares being transferred were two 600 lb. control moment gyros. "They've done a tremendous job of really outfitting station with all the spares that are going to be needed, essentially through its lifetime," Bill Gerstenmaier, NASA Associate Administrator for Space Operations.<br><br><b>KSC W/D</b><br>OPF: 113 days + 10 non-workdays + 1 holiday<br>VAB: 7 days + 1 contingency day<br>PAD A: 32 days + 2 contingency days<br>Total Work Days = 152 (OPF processing occurred over a total time period of 124 days.)<br><br><b>POSTPONEMENTS:</b><br>- Baselined STS-129 to FDRD - launch date of 10/15/09 on 10/06/08.<br>- Ppd. to 11/12/09 on 12/04/08. Interim manifest while HST final placement is considered.<br>- Ppd. to 11/16/09 at 10/29/09 FRR. Slip due to latest SSP planning.<br><br><b>LAUNCH SCRUBS:</b> None.<br><br><b>LAUNCH WINDOW:</b> Total launch window was 9M 01S with window open at 320:19:23:37Z and close at 320:19:32:38Z. Preferred Launch Time was 320:19:28:10Z (In-Plane Time) for a launch window of 4M 28S.<br><br><b>LAUNCH DELAYS:</b><br>- None. Launch occurred on time at 320:19:28:10Z, 2:28:10 PM EST, Monday, November 16, 2009. A cloud ceiling below 5000 feet developed early in the morning, violating flight rule limits. The ceiling lifted to above flight rule limits about 5 hours prior to launch, but continued to violate US Air Force Range Safety cloud criteria. Astronaut Steve Lindsey, flying weather reconnaissance, provided measurements of the cloud thickness for the 45th Space Wing's Launch Weather Officer and found the thickness to be acceptable about 3 hours prior to launch.. (Courtesy NWS SMG Post-Mission Summary.)<br><br>Continued... |  |  |
| SEQ<br>FLT # 129   | OMS PODS                          | PLT<br>Barry E. Wilmore<br>P811/R348/M301   | LAUNCH WINDOW:<br>9M 01S (Total)<br>4M 28S (Preferred)   | XRANGE: 344.1NM  | 1 = 2048 (10)<br>2 = 2044 (12)<br>3 = 2058 (4)<br><br>M 3 EOM:<br>WEIGHT:<br>206917 LBS<br>X CG:<br>1083.8 IN   |  |              |   |              |   |  |  |  |
| KSC-129  | LPO4-30<br>RPO1-38<br>FRC4-31     | MS 1<br>Leland Melvin<br>(Flt 2 - STS-122)<br>P812/R319/V209/M275<br><br>MS 2<br>Randy Bresnik<br>P813/R349/M302<br><br>MS 3<br>Mike Foreman<br>(Flt 2 -STS-123)<br>P814/R324/V210/M280 | EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN,<br>FMI (Cloud Ceiling)<br><br>SELECTED:<br>RTL: KSC33N/N<br>TAL: ZZA 30L N/SFD<br>AOA: KSC 33 N/N<br>1 <sup>ST</sup> DAY PLS: EDW<br>22L N/N<br><br>TDEL:<br>0.000 (P) -0.072 (A)<br><br>MAX Q NAV:<br>760.9 (P) 733.8 (A)<br><br>SRB STG:<br>2:03.0 (P) 2:04.0 (A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (ZZA):<br>2:36 (P) 2:43 (A)<br><br>NEG ZZA (2@ 104):<br>3:52 (P) 3:57(A)<br><br>PTA (U/S 157 FPS):<br>5:08(P) 5:09(A)<br><br>SE TAL (ZZA 104):<br>5:57(P) 6:13(A)<br><br>Continued... | ORBIT DIR: A/L (43)<br>AIM PT: (Close-In)<br><br>MLGTD: 2971 FT<br>331:14:44:20Z<br>VEL: 184 KGS<br>197 KEAS<br>HDOT: -2.1 FPS<br><br>TD NORM 195:<br>2989 FT<br><br>DRAG CHUTE<br>DEPLOY: 189 KEAS<br>331:14:44:24Z<br><br>Continued... |   |  |              |   |              |   |  |  |  |
| PAD 39A<br>(52)  |                                   |   |  |  |   |  |              |   |              |   |  |  |  |
| MLP-3  |                                   |   |  |  |   |  |              |   |              |   |  |  |  |
| 31 <sup>th</sup><br>SHUTTLE<br>FLIGHT<br>TO ISS  |                                   |   |  |  |   |  |              |   |              |   |  |  |  |
| <div><div></div><div></div></div> |                                   |   |  |  |   |  |              |   |              |   |  |  |  |
| <div><div></div><div><div>NOTE: Ares Program Cancelled in 2010.</div></div></div>                                |                                   |   |  |  |   |  |              |   |              |   |  |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY





Page 2-218 - STS-129/ULF3

| FLT NO.                          | ORBITER | CREW (6 UP/6+1 DN)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.                                 | SRB RSRM AND ET   | ORBIT INC HA/HP |  | FSW  | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|----------------------------------|---------|---|---|--|--|---|-----------------|--|--|--|---|
| STS-129/<br>ULF3<br>Continued... |         | Continued...<br><br>SS EVA 147<br>DOCKED QUEST EVA 65<br>EMU/TETHERED EVA 140<br>SCHEDULED EVA 138<br>DURATION 5:42   | Continued...<br><br><u>PTM (U/S 181 FPS):</u><br>6:11(P) 6:13(A)<br><br><u>SE PRESS 104</u><br>6:56(P) 6:56 (A)<br><br><u>MECO CMD:</u><br>8:24.2(P) 8:24.3 (A)<br><br><u>VI:</u><br>25819(P) 25819(A)<br><br><u>OMS-2:</u><br>37:55 (P) 38:15(A)<br>98.8(P) 96.7(A)<br>FPS | Continued...<br><br><u>BRK DECEL FPS²:</u><br>AVE 6.4 PK 7.9<br><br><u>NLGTD:</u> 5810 FT<br>331:14:44:30Z<br><u>VEL:</u> 140 KGS<br>150 KEAS<br><u>HDOT:</u> -5.1 FPS<br><br><u>BRK INIT:</u> 100 KGS<br><br><u>DRAG CHUTE JETTISON:</u><br>51 KGS<br>331:14:44:25Z<br><br><u>BRK DECEL FPS²:</u><br>AVE 6.4 PK 7.9<br><br><u>WHEELS STOP:</u><br>331:14:45:04Z<br>9557 FT<br><br><u>ROLLOUT:</u><br>6586 FT<br>0:44 M:S<br><br><u>WINDS:</u><br>11H KTS -1L KTS<br><u>OFFICIAL:</u><br>33011P17KTS<br>(X1P2H11P17)<br><br><u>DENS ALT:</u> - 473 FT<br><br><u>FLT DURATION:</u><br>10:19:16:14<br><u>S/T:</u><br>1236:17:41:41<br><u>OV-104:</u><br>281:23:59:12<br><u>DISTANCE:</u><br>4,490,138 sm<br><u>TOTAL SHUTTLE DISTANCE:</u><br>507,595,072 sm |  |   |                 | Continued...<br><br><u>PAYLOADS:</u><br><u>MIDDECK:</u><br>ISS-ULF3, MAUI, SEITE, SIMPLEX, RAMBO-2<br><br>5 CRYO TANK SETS<br>ODS, SRMS (86), OBSS | Continued...<br><br><b><u>TAL WEATHER:</u></b> Weather on launch day caused a couple minor issues at back-up site, Istres. Weather conditions at Zaragoza, the prime TAL site, and Moron were observed and forecast acceptable throughout the countdown. However, a cloud ceiling developed at Istres 2 hours prior to launch limiting the use of that landing site. (Courtesy NWS SMG Post-Mission Summary.) Istres became GO close to launch update.<br><br><b><u>PERFORMANCE ENHANCEMENTS:</u></b><br>Include the standard set plus: 1) PE Operational High Q - TRN/NOV, 2) OMS Assist, 3) a 52 nautical mile MECO, and 4) Del Psi<br><br><b><u>FLIGHT DURATION CHANGES:</u></b><br>None. Landed on KSC Runway 33 at 331:14:44:21Z, Friday, November 27, 2009, at 8:24:21 CST.<br><br><b><u>FIRSTS/SECONDS/LASTS:</u></b><br>Second child born while astronaut dad in space. Randy Bresnik's wife, Rebecca, gave birth to Abigail Mae Bresnik, 6 lbs 13 oz, at 11:04 p.m. Saturday, Nov. 21st, in Houston. First "dad while in space" was Mike Fincke in 2004 on ISS during a 6 mo tour- a girl. First Orthopedic Surgeon in space: Dr. Robert Satcher, Jr. First flight of new variable Alt DAP<br>First flight ET replaced LH2 ice Frost Ramp (IFR) base TPS with NCFI at 14 locations<br>First Flight SSME Nozzle Corrosion Inhibitor Application Change<br>First Monarch Butterflies delivered to ISS. Butterflies took flight on 12/09/09 as monitored by thousands of students back on Earth. Super Bowl XLIV opening-toss coin flown to ISS & returned.<br><br><b><u>NIGHT LAUNCH:</u></b> N/A<br><br><b><u>RENDEZVOUS: #76</u></b> Rendezvous and dock with ISS.<br><br><b><u>EVENTS:</u></b><br>- FD1: OMS2 ignition at 320:20:06:25Z resulted in a 125.0 by 84.8 NM orbit.<br>- FD2: RCC inspection found no areas of concern<br>- T1 maneuver at 322:14:05:57Z resulted in a 185.6 by 179.5 NM orbit<br>- FD3: R-Bar Pitch Maneuver was performed. No issues.<br>- Docking Contact occurred at 322:16:51:16Z<br><br>Continued... |  |   |
|                                  |         | <br><br>MCC WHITE FLIGHT FCR (59)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>A/E- Bryan Lunney<br>LD/O1- Mike Sarafin<br>O2- Gary Horlacher<br>Planning- PaulDye<br>MOD – John Mccullough<br>Team 4- Kwatsi Alibaruho<br><br><u>ISS</u><br>O1 - Emily Nelson<br>LD/O2 – Brian Smith<br>O3 – Jerry Jason<br>Team 4 - Heather Rarick<br><br>Continued... |   |  |  |   |                 |  |  |  |   |
|                                  |         |   |   |  |  |  |                 |  |  |  |   |
|                                  |         |   | <b>STS129-S-027 (16 Nov. 2009) --- NASA mission managers monitor Atlantis launch in KSC FR 4. Bill Gerstenmaier, NASA Assoc. Administrator for Space Operations is at bottom left. Photo Credit: NASA/Bill Ingalls.</b>   |  |  |   |                 |  |  |  |   |
|                                  |         |   | <b>ISS021-E-029824 (18 Nov. 2009) --- Atlantis loaded with spares is photographed on approach to ISS by an Expedition 21 crew member. The Russian Progress 35P spacecraft is docked at left.</b>  |  |  |   |                 |  |  |  |   |








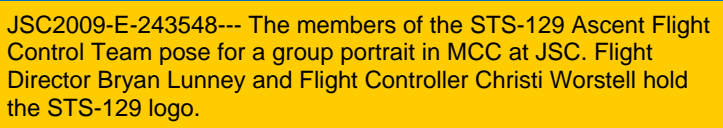
# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-219 -STS-129/ULF3

| FLT NO.  | ORBITER   | CREW<br>(6 UP/6+1 DN)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br><br>AND<br>ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|--|---|--|--|---|---|------------------------------|------------------------|--|-----|---|---|
| STS-129/<br>ULF3<br><br>Continued...   |   | Continued...<br><br><u>CAPCOMS:</u><br><u>SHUTTLE</u><br>A/E - Chris Ferguson<br>- Steve Frick (Wx)<br>LD/O1 - Stan Love<br>O2 - Megan McArthur<br>Planning - Aki Hoshide<br>Team 4 - N/A<br><u>ISS</u><br>O1 - Drew Feustel<br>LD/O2- Steve Swanson<br>O3 - Ryan Lien<br>Team 4 - N/A |  |     |   |                              |                        |  |     |   | Continued...<br><br><u>EVENTS: Continued...</u><br>- Hard Dock, hooks closed, occurred at 322:17:03:49<br>- ISS Hatch opened at 12:28 PM CST, Nov. 18, 2009, welcomed by ISS crew. At that time Stott ended her stay as EXP 21 FE and became an STS-129 MS.<br>- FD4: EVA 1: Foreman & Satcher successfully completed all ISS maintenance and spares transfer tasks ahead of schedule. A get-ahead task was the most difficult. In releasing a cargo platform, a spring loaded device jammed and had to be manhandled to achieve release. EVA1 duration 6:37.<br>- MMT concurred that no Focused Inspection of Orbiter was required.<br>- FD6: EVA2: Russian false depress event overnight, but EVA2 was conducted on time. Foreman & Bresnik completed all nominal tasks plus the following get-aheads: S3 Nadir/Inboard PAS Deploy, SGANT Y-cable check (CHIT 8025) , Tool stanchion relocation to P1 WIF 3, & APFR 5 retrieve. EVA2 duration 6:08.<br>- FD8: EVA3: Satcher & Bresnik: EVA-3 started one hour late due to EV2's drink bag valve coming loose. All tasks successfully completed included: transfer of HPGT & MISSE & from ExPRESS Logistics Carrier 2 to Quest airlock. Towards the end of the EVA two [unknown] items were lost overboard at 327:17:37Z. All tools were accounted for. EVA3 duration (PET) 5:42.<br>- Hard Dock, hooks closed, occurred at 322:17:03:49<br>- ISS Hatch opened at (12:28 PM CST, Nov. 18, 2009) welcomed by ISS crew. At that time Stott ended her stay as EXP 21 FE and became an STS-129 MS. |
| ----- SPACEMEN AT WORK -----   |   |  |  |   |   |                              |                        |  |     |   |   |
|  |  |   | <p>ISS021-E-030165 (19 Nov. 2009) Foreman installing a spare S-band antenna structural assembly to the Z1 segment of the station's truss. EVA 1.</p> <p>S129-E-007762 " New Dad In Space", Bresnik, installing a Grappling Adaptor to On-Orbit Railing Assembly (GATOR) on Columbus Lab. EVA 2. (21 Nov. 2009)</p> <p>S129-E-008103 (23 Nov. 2009) Satcher moves debris shields from Quest airlock to the External Stowage Platform #2. EVA 3.</p> |   |   |                              |                        |  |     |   |   |
|  |   |  |  |   |   |                              |                        |  |     |   | <p>-Transfers:<br/>31,789 Pounds of hardware transferred to station (inside &amp; out)<br/>40 Pounds of Oxygen "transferred" (pumped) into ISS cabin<br/>11 Pounds of Nitrogen transferred into ISS tanks<br/>2,211 Pounds of middeck items delivered to ISS<br/>2,110 Pounds of middeck items returned from ISS<br/>~1,400 Pounds of water transferred to ISS</p> <p>- Mass in space of the ISS 759,222 pounds<br/>- ISS assembly: 86 Percentage complete<br/>- FD10: Undocked at 329:09:53:02Z<br/>- During Entry there was no RF blackout. It was avoided by a handover to the Eastern TDRS early, then a handover to the ground station.</p> <p>Continued...</p>  |



# SPACE SHUTTLE MISSIONS SUMMARY



| FLT NO.   | ORBITER | CREW (6 Up/6+1 DN)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N. | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC HA/HP   |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)  |
|---|---------|---|--|--|---|--------------------------|--|--|-----|--|---|
| STS-129/<br>ULF3<br>Continued...  |         |    |  |  |   |                          |    |  |     |  | Continued...<br><br><b>SIGNIFICANT ANOMALIES:</b><br><u>Orbiter:</u><br>- WASTE DUMP STOPPED PREMATURELY. THE WASTE WATER DUMP INITIATED POST-UNDOCK AT APPROX. 329/12:07:38 GMT, EXHIBITED A NOMINAL WASTE DUMP RATE (APPROX. 2.0 %/MIN) UNTIL APPROX. 329/12:19:36 GMT WHEN THE WASTE DUMP RATE DEGRADED TO 0.3/ %/MIN. WASTE DUMP WAS TERMINATED BY CLOSING THE DUMP VALVE AND NOZZLE WAS REHEATED TO APPROX. 258 DEG F. DUMP VALVE WAS THEN OPENED AT 329/12:35:34 GMT FOR CONTINUATION OF THE DUMPING OPERATION. THE OBSERVED DUMP RATE CONTINUED OFF-NOMINALLY AT NEAR 0 %/MIN AND THE WASTE DUMP WAS TERMINATED AFTER 19 MINUTES. This IFA is considered a constraint to STS-132/ULF4 (next flight of OV-104), but is expected to be resolved with a dump line filter change.<br>- APU water tank heater A (50V46HR01A) did not operate at expected temp. APU water tank temp<br>- LRCS BFS FUEL AND OXIDEZER QUANTITIES INCREASED OFF NOMINAL<br><u>KSC:</u> None.<br><u>SRB:</u><br>RH SOLID ROCKET BOOSTER AFT SKIRT FOAM ON THE OUTBOARD SIDE OF HOLDDOWN POST M2 NEAR THE GN2 PURGE LINE IS OBSERVED TO CRACK DURING LIFTOFF<br><u>RSRM:</u> None.<br><u>SSME:</u> None.<br><u>ET:</u> None.<br><u>MOD:</u> None.<br><u>Integration:</u><br>- Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)<br>- Single Transient SRB I/O Error at Liftoff |
| JSC2009e240939<br>--- In MCC, Tim Oram with the Space Flight Meteorology Group gathers data for weather forecast. |         |   |  |  |   |                          |   |  |     |  |   |
| JSC2009-E-244757 ---<br>In MCC, Joshua Byerly/PAO narrates mission post undocking activities.                     |         |  |  |  |   |                          |  |  |     |  |   |

# SPACE SHUTTLE MISSIONS SUMMARY

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (6)<br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br>AND ET | ORBIT |  | FSW          | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|---|--|---|--|--------------------|-------|--|--------------|--|---|
| STS-130/ 20A<br>Continued...  |         | Continued...<br><br>MCC WHITE FLIGHT FCR (60)<br><br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>A/E- Norm knight<br>LD/O1- Kwatsi Alibaruho<br>O2- Gary Horlacher<br>Planning- Chris Edelen<br>MOD – John Mccullough<br>Team 4- Paul Dye<br><br>ISS<br>O1 - Royce Renfrew<br>LD/O2 - Bob Dempsey<br>O3 - Mike Lammers<br>Team 4 - Dana Weigel | Continued...<br><br><u>PTM (U/S 181 FPS):</u><br>6:10(P) 6:12(A)<br><br><u>SE PRESS 104</u><br>6:57(P) 6:56 (A)<br><br><u>MECO CMD:</u><br>8:22.5 (P) 8:21.4 (A)<br><br><u>VI:</u><br>25819(P) 25817(A)<br><br><u>OMS-2:</u><br>37:44 (P) 37:42(A)<br>143.4(P) 142.1(A)<br>FPS |    |  |                    |       |  | Continued... |  |   |
| <u>CAPCOMS:</u><br><u>SHUTTLE</u><br>A/E - Rick Sturckow<br>- Steve Frick (Wx)<br>LD/O1 - Danny Olivas<br>- Rick Sturckow<br>(Flt Days 3 & 12)<br>O2 - Mike Massimino<br>Planning - Shannon<br>Lucid<br>Team 4 - N/A<br><u>ISS</u><br>O1 - Robert Hanley<br>LD/O2- Hal Getzelman<br>O3 – Kathy Bolt   |         |   |  |    |  |                    |       |  |              |  |   |
| Prelaunch in JSC MOCR, Flight Dynamics Officer (FDO) Mark McDonald works on abort landing site planning.  |         |   |  | Endeavour launch as seen in time lapse photo from top of the Intracoastal Waterway Bridge in Ponte Vedra, FL, 115 Miles from the launch site, Monday, February 8, 2010 @ 4:14 am EST. Photo by: James Vernacotola, copyright 2010: <a href="http://www.jamesvernacotola.com">www.jamesvernacotola.com</a> |  |                    |       |  |              |  |   |
| <p><b>FLIGHT DURATION CHANGES:</b><br/>On FD6 MMT agreed to add +1 day to nominal flight plan to facilitate complete transfer of the regen ECLSS racks to Node 3 as well as assist with accomplishing other flight objectives. Landed on KSC Runway 15 at 05:03:20:29Z, Sunday, February 21, 2010 at 9:20:29 CST.</p> <p><b>FIRSTS/LASTS:</b><br/>- Shuttle's last night launch.<br/>- Last U.S. on-orbit Segment (Node 3) installed on ISS.<br/>- Orbiter: First flight of Main Engine Ignition Overpressure Acoustic Instrumentation.<br/>- First lunar rock returned to space. The sample was collected on Apollo 11 by Neil Armstrong in 1969 and carried by Scott Parazynski (Shuttle astronaut) in 2009 on his climb of Mt. Everest. Now on ISS, it orbits Earth once again.</p> <p><b>NIGHT LAUNCH: # 34</b></p> <p><b>NIGHT LANDING KSC #17: (#23 in Shuttle history)</b></p> <p><b>RENDEZVOUS: #77</b> Rendezvous and dock with ISS.</p> <p><b>EVENTS:</b><br/>- FD1: OMS2 ignition at 039:09:51:49Z resulted in a 124.0 by 110.0 NM orbit.<br/>- FD2: During RCC surveys the crew downlinked some views of pulled up portion of port wing upper surface flapper door seal area. Area was cleared.<br/>- T1 maneuver at 041:02:28:25Z resulted in a 187.4 by180.7 NM orbit<br/>- FD3: R-Bar Pitch Maneuver was performed. No issues. MMT concurred no focus inspection required.<br/>- Docking Contact occurred at 041:05:05:56Z<br/>- Hard Dock, hooks closed, occurred at 041/05:54:12Z<br/>- ISS Hatch opened at 1:16 AM CST Wednesday, Feb. 10, 2010, welcomed by ISS crew.<br/>- FD4: EVA 1: Behnken &amp; Patrick successfully completed preparations for unberthing Tranquility (Node 3). ISS arm unberthed Node 3 &amp; installed it on Node 1 port side followed by crew activation. EVA1 duration 6:32.<br/>- FD7: EVA2: Behnken &amp; Patrick All planned activities were completed including installation of the ammonia jumpers, integrating Node 3 to EATCS Loop A, and installing the Node 3 port center disc cover (CDC). Cupola was successfully relocated. EVA2 duration 5:53.</p> <p>Continued...</p> |         |   |  |   |  |                    |       |  |              |  |   |







# SPACE SHUTTLE MISSIONS SUMMARY

[illegible]






# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-224 - STS-130/20A

| FLT NO.   | ORBITER | CREW (6)<br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES, FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG, THROTTLE PROFILE, ENG. S.N. | SRB RSRM AND ET  | ORBIT INC HA/HP | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------|----------------------------------|---|--|--|--|-----------------|-----|--|---|
| STS-130/20A<br>Continued...   |         |                                  | Quoting Oscar Wilde's "Life imitates art far more than art imitates life", Dave Zani - CinemaBlend.com, sees the Cupola window as the inside window of a Star Wars TIE Fighter. |  |  |  |                 |     |  | Continued...<br><br><b>SIGNIFICANT ANOMALIES:</b><br><u>Orbiter:</u><br>- During STS-130 Ascent monitoring, WLE Sensor Unit S/N 1155 experienced two (2) off-scale high data spikes.<br>- MUX bypass switch will not switch to Bypass front for OCA 48Mbps downlinks.<br>- Audio drop-out during EVA 1.<br>- Trajectory Control Sensor (TCS) had trouble transitioning to CW mode. CW data became ratty and unusable.<br><u>KSC:</u><br>12 IFA's entitled "STS-130 Post Launch Debris"<br><u>SRB:</u> None.<br><u>RSRM:</u> None.<br><u>SSME:</u> None.<br><u>ET:</u><br>- POST-FLIGHT REV. IDENT. 2 FOAM LOSSES +Z SIDE INTERTANK NCFI 24-124 ACREAGE, 19 FOAM LOSSES ?? SIDE OF THE INTERTANK NCFI 24-12 ACREAGE<br><u>MOD:</u><br>- INCORRECT TAL RUNWAY SURFACE IN FLIGHT RULE<br><u>Integration:</u> None. |
|   |         |                                  |    |  |  |   |                 |     |  |   |
| ISS022-E-067184 --- Behnken (left) & Patrick removing insulation blankets & launch bolts from Cupola's windows.               |         |                                  | S130-E-010380--- Soichi Noguchi/JAXA/FE ISS Exp 22, takes earth photo from a window in Cupola.  |  |  | ISS022-E-068724 -- CDR Zamka tries out view from Cupola.   |                 |     |  |   |
|    |         |                                  |    |  |  |    |                 |     |  |   |
| JSC2010-E- 017955 --- Flight Directors in JSC MCC: From left: Chris Edelen, Norm Knight, Kwatsi Alibaruho and Gary Horlacher. |         |                                  | S130-E-012188 --- ISS as seen by Endeavour post-undocking and separation. Tranquility & Cupola are located just left of center.   |  |  | STS130-S-128 --- Drag chute is deployed at MLGTD on KSC Runway 15 at 10:20:29 PM EST on Feb. 21, 2010. It was the 23rd night landing in Shuttle history and the 17th at KSC. |                 |     |  |   |

# SPACE SHUTTLE MISSIONS SUMMARY




Page 2-225 - STS-131/19A

| FLT NO.  | ORBITER   | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE,<br>LIFTOFF TIME,<br><br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br><br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br><br>AND<br>ET  | ORBIT        |   | FSW   | PAYLOAD<br>WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |
|--|---|---|--|--|---|---|--------------|---|---|--|--|--|
| STS-131/19A  | OV-103<br>(Flight 38)<br>DISCOVERY                | CDR:<br>Alan G. Poindexter<br>(Flt 2- STS-122)<br>P823/R318/V214/M274   | KSC 39A<br>95:10:21:25Z<br>6:21:25 AM EDT (P)<br>6:21:25 AM EDT (A)<br>Monday (17)<br>04/05/10 (16)  | KSC33 KSC (74)<br>110:13:08:34Z<br>8:08:34 AM CDT<br>Tuesday (18)<br>04/20/10 (12)   | 104/104/<br>109%<br><br><u>PREDICTED:</u><br>100/104.5/104.5/<br>72/104.5<br><br><u>ACTUAL:</u><br>100/104.5/100/<br>72/104.5<br><br>1 = 2045 (11)<br>2 = 2060 (2)<br>3 = 2054 (10) | BI-142<br><br>RSRM<br>110<br><br>ET-135<br>SLWT<br>39<br><br>ET<br><u>IMPACT</u><br>1:13:55<br>MET<br><br><u>LAT:</u><br>37.233 S<br><br><u>LONG:</u><br>159.667<br>W | 51.6<br>(33) | DIRECT<br>INSERTION<br><br><u>POST OMS-2</u><br>140.0x123.8<br>NM<br><br><u>DEORBIT</u><br>HA 190.6 NM<br>HP 14.2 NM<br><br><u>ENTRY<br/>VELOCITY:</u><br>25862 FPS<br><br><u>ENTRY<br/>RANGE:</u><br>4480 NM | OI-34<br>(4)<br><br><u>CARGO:</u><br>39516 LBS<br><br><u>PAYLOAD<br/>CHARGEABLE:</u><br>32131 LBS<br><br><u>DEPLOYED:</u><br>30512 LBS<br><br><u>NON-DEPLOYED:</u><br>1388 LBS<br><br><u>MIDDECK:</u><br>231 LBS<br><br><u>SHUTTLE<br/>ACCUMULATED<br/>WEIGHTS:</u><br><u>DEPLOYED:</u><br>1672045 LBS<br><br><u>NON-DEPLOYED:</u><br>1627930 LBS<br><br><u>CARGO TOTAL:</u><br>4250445 LBS<br><br><u>PERFORMANCE<br/>MARGINS (LBS):</u><br>FPR: 2908<br>FUEL BIAS: 1059<br>FINAL TDDP: 1133<br>RECON: 1491<br><br><u>PAYLOADS:</u><br><u>PLB:</u> ISS-19A<br>(MPLM,LMC),<br>TRIDAR AR&D<br>SENSOR DTO-<br>701A<br><br><u>MIDDECK:</u><br>ISS-19A, MAUI,<br>SEITE,<br>SIMPLEX,<br>RAMBO-2<br><br>5 CRYO TANK<br>SETS<br>ODS, SRMS (88),<br>OBSS, SSPTS, | <i><u>Brief Mission Summary:</u> The STS-131 (33rd mission to ISS), dubbed "Experiment Express" by PAO, main objectives were to bring some 8 tons of supplies and scientific equipment to ISS, remove &amp; replace a depleted Ammonia tank, and return a large load of experiments and no longer useful gear back to earth.</i><br><br><u>KSC W/D</u><br>OPF: 142 days + 11 holidays<br>VAB: 9 days + 0 contingency days<br>PAD A: 32 days + 2 contingency days<br>Total Work Days = 183 (OPF processing occurred over a total time period of 153 days<br><br><u>POSTPONEMENTS:</u><br>- Baselined STS-131 to FDRD - launch date of 03/18/10 on 02/05/09.<br>- Ppd. to 04/05/10 on 03/09/10. Due to cold weather conditions, Orbiter rollover from the OPF to VAB was delayed such that the March 18, 2010 launch date could not be met.<br><br><u>LAUNCH SCRUBS:</u> None<br><br><u>LAUNCH WINDOW:</u> Dual pane day with window open at 95:10:18:40Z and close at 95:10:27:17Z. Preferred Launch Time was 95:10:21:25Z (In-Plane Time) for a launch window of 5M52S.<br><br><u>LAUNCH DELAYS:</u> None. Launch occurred on time at 95:10:21:25Z on Monday 04/05/10.<br><br><u>TAL WEATHER:</u> Spaceflight Meteorology Group (SMG) reported a pressure gradient between a high & a departing low contributed to winds at Istres above headwind limits. Only high cirrus clouds prevailed at both Zaragoza & Moron with winds well within flight rule limits. Weather was "GO".<br><br><u>PERFORMANCE ENHANCEMENTS:</u><br>Include the standard set plus: 1) PE Operational High Q - TRN/APR, 2) OMS Assist, 3) a 52 nautical mile MECO, and 4) Del Psi<br><br><u>FLIGHT DURATION CHANGES:</u><br>- FD 4: MMT approved plan for conducting a docked late inspection using +1 day - extended mission from 12 to 13 days.<br>- Landing postponed 1 day due to unstable weather. Weather was still unsatisfactory next day with fog and area showers for first opportunity. Weather cleared for "Go" on 2nd opportunity at KSC. Landing occurred at 110:13:08:34Z, Tuesday, April 20, 2010, at 8:08:34 AM CDT<br><br>Continued... |  |  |
| SEQ<br>FLT # 131   | <u>OMS PODS</u><br>LPO1 -41<br>RPO3-39<br>FRC3-38 | PLT<br>James P. Dutton, Jr.<br>P824/R352/M305   |  |  |   |   |              |   |   |  |  |  |
| KSC-131  |   | MS 1<br>Rick Mastracchio<br>(Flt 3 - STS-106, STS-118)<br>P825/R257/V189/M224   | <u>LAUNCH WINDOW:</u><br>Dual pane day with window open at 95:10:18:40Z and close at 95:10:27:17Z<br>5M 52S (Preferred)  | <u>DEORBIT BURN:</u><br>110:12:02:59Z<br><br><u>XRANGE:</u> 20.4 NM<br><br><u>ORBIT DIR:</u> D/L (50)<br><u>AIM PT:</u> NOMINAL  |   |   |              |   |   |  |  |  |
| PAD 39A<br>(54)  |   | MS 2<br>Dorothy Metcalf-Lindenburger<br>P826/R353/F48   |  | <u>ORBIT DIR:</u> D/L (50)<br><u>AIM PT:</u> NOMINAL   |   |   |              |   |   |  |  |  |
| MLP-3  |   | MS 3<br>Stephanie Wilson<br>(Flt 3 - STS-121, STS-120)<br>P827/R298/V190/F39  | <u>EOM PLS:</u> KSC<br><u>TAL:</u> ZZA<br><u>TAL WX:</u> MRN<br>FMI (NO GO)<br><br><u>SELECTED:</u><br><u>RTLS:</u> KSC33 N/N<br><u>TAL:</u> MRN20 N/N<br><u>AOA:</u> KSC33 N/N<br><u>1ST DAY PLS:</u> KSC15<br>N/N<br><br><u>TDEL:</u><br>0.000 (P) 0.142 (A) | <u>MLGTD:</u> 3559 FT<br>110:13:08:34Z<br><u>VEL:</u> 198 KGS<br>198 KEAS<br><u>HDOT:</u> -1.6 FPS<br><br><u>TD NORM 195:</u><br>2955 FT<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u> 191 KEAS<br>110:13:08:36Z<br><br><u>NLGTD:</u> 6398 FT<br>110:13:08:43Z<br><u>VEL:</u> 157 KGS<br>160 KEAS<br><u>HDOT:</u> -4.4 FPS<br><br><u>BRK INIT:</u> 107 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u><br>58 KGS<br>110:13:09:31Z<br><br><u>WHEELS STOP:</u><br>11886 FT<br><br><u>ROLLOUT:</u><br>8327 FT<br>0:58 M:S<br>Continued... |   |   |              |   |   |  |  |  |
| 33rd<br>SHUTTLE<br>FLIGHT<br>TO ISS  |   | MS 4<br>Naoko Yamazaki (JAXA)<br>P828/R354/F49<br><br>MS5<br>Clayton Anderson<br>(Flt 2-UP ON STS-117STAY<br>ISS, DN ON STS-120)<br>P829/R310/V215/ M268<br><br>SS EVA 151<br>DOCKED QUEST EVA 69<br>EMU/TETHERED EVA 144<br>SCHEDULED EVA 142<br>DURATION 6:27<br><br>SS EVA 152<br>DOCKED QUEST EVA 70<br>EMU/TETHERED EVA 145<br>SCHEDULED EVA 143<br>DURATION 7:26<br><br>SS EVA 153<br>DOCKED QUEST EVA 71<br>EMU/TETHERED EVA 146<br>SCHEDULED EVA 144<br>DURATION 6:24<br><br>Continued... |  |  |   |   |              |   |   |  |  |  |
|  |   |   |  |  |   |   |              |   |   |  |  |  |
|  |   |   |  |  |   |   |              |   |   |  |  |  |
|  |   |   |  |  |   |   |              |   |   |  |  |  |
|  |   |   |  |  | ISS023-E-020718 --- ISS robotic Canadarm2 relocates Leonardo (MPLM) from Discovery's PLB to port on Harmony node.   |   |              |   |   |  |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

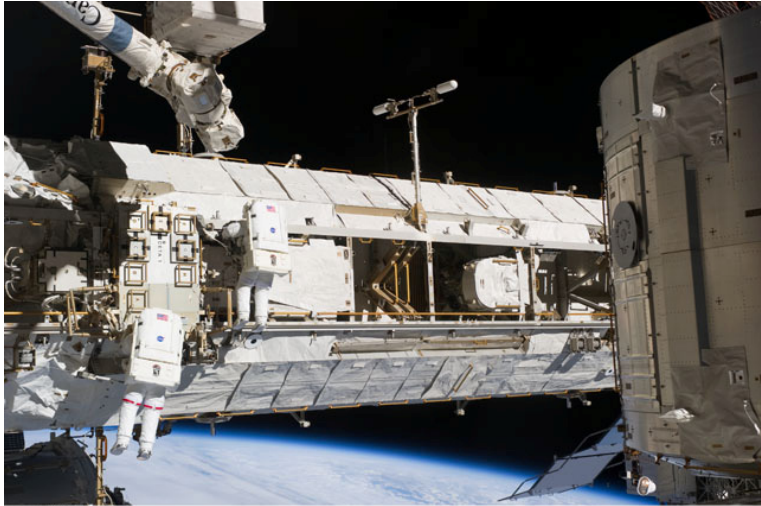
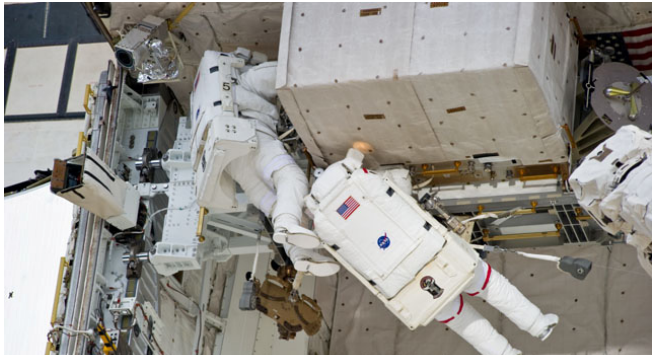

Page 2-226 - STS-131/19A

| FLT NO.   | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE LANDING TIMES FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.                                 | SRB RSRM AND ET | ORBIT INC HA/HP   |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS   | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---------|--|--|--|--|-----------------|---|--|-----|--|---|
| STS-131/19A<br>Continued...   |         | Continued...<br><br>MCC WHITE FLIGHT FCR (61)<br><br><u>CAPCOMS:</u><br><u>SHUTTLE</u><br>A/E - Rick Sturckow<br>- George Zamka/Wx<br>LD/O1 - Rick Sturckow<br>O2 - Aki Hoshide<br>Planning<br>- Megan McArthur<br>- Chris Cassidy<br>Team 4 - N/A<br><br><u>ISS</u><br>O1 - Mike Jensen<br>LD/O2 - Stan Love<br>O3 - Marcus Reagent<br>Team 4 - N/A | Continued...<br><br><u>PTM (U/S 180 FPS):</u><br>6:20(P) 6:29(A)<br><br><u>SE PRESS 104</u><br>6:58(P) 7:01 (A)<br><br><u>MECO CMD:</u><br>8:22.5 (P) 8:23.5 (A)<br><br><u>VI:</u><br>25819(P) 25816(A)<br><br><u>OMS-2:</u><br>37:16 (P) 37:14(A)<br>197.2(P) 196.5(A)<br>FPS | Continued...<br><br><u>WINDS:</u><br>2.1H KTS 2.2R KTS<br><u>OFFICIAL:</u><br>02003P05KT (X0P0 H5P6)<br><br><u>DENS ALT:</u> 908 FT<br><br><u>FLT DURATION:</u><br>15:02:47:09<br><br><u>S/I:</u><br>1265:14:35:12<br><br><u>OV-103:</u><br>347:03:20:09<br><br><u>DISTANCE:</u><br>6,232,235 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>519,613,765 sm   |  |                 | STS131-S-050 --- NASA Commentator Mike Curie and astronaut Kathryn (Kay) Hire discuss launch in LCC Firing Room 4 at KSC. |  |     | Continued...<br><br><u>FIRSTS/LASTS:</u><br>- Last return trip for MPLM Leonardo. After STS-133 it will remain on ISS as a permanent fixture.<br>- First time for four women living in space.<br>- First time for two Japanese astronauts in space together.<br>- First special cookies from the Italian Café in Seabrook, TX, requested originally by Col. Timothy Creamer after a 6-month ISS tour, were delivered to ISS. The sand tarts passed NASA tests with the request to go light on the powdered sugar.<br><br><u>NIGHT LAUNCH:</u> N/A<br><br><u>RENDEZVOUS: #78</u> Rendezvous and dock with ISS.<br><br><u>EVENTS:</u><br>- FD1: OMS2 ignition at 095:10:58:39Z resulted in a 140.0 by 123.8 NM orbit.<br>- FD2: During RCC surveys showed no areas of concern.<br>- T1 maneuver at 097:05:06:44Z resulted in a 189.3 by 181.7 NM orbit<br>- Ku Band failed.<br>- FD3: R-Bar Pitch Maneuver was performed. Four areas of interest were identified: 1) RSB Trailing Edge Tile, 2) FWD Gap Filler, 3) Port ET Door Tile Chip, 4) three closely grouped OMS POD tile damage sites. The Damage Assessment Team later cleared these areas for entry and MMT concurred no focus inspection required.<br>- Crew executed the radar fail procedures for rendezvous after the system failed to respond to a last attempt early in the rendezvous.<br>- Docking Contact occurred at 097:07:44:09Z<br>- Hard Dock, hooks closed, occurred at 097:07:58:52Z<br>- ISS Hatch opened at 4:11 AM CDT April 7, 2010, welcomed by ISS crew.<br>- FD4: MPLM was grappled, unberthed, and installed on the Node 2 Nadir without issue.<br>- FD5: EVA 1:Mastracchio & Anderson remove old ATA and handover new ATA to SSRMS, retrieve JEM SEED, & R&R RGA. EVA1 duration 6:27.<br><br>Continued... |   |
|  |         |   |  | S131-E-010002 --- STS-131 & EXP 23 crews gather in ISS Kibo Lab STS-131 crew members pictured (light blue shirts) are CDR Poindexter, PLT Dutton; Anderson/MS, Mastracchio/MS, Metcalf-Lindenburger/MS, Wilson/MS, & Yamazaki/MS (JAXA). EXP 23 crew members are CDR Oleg Kotov (RSA), Mikhail Kornienko/FE (RSA), Alexander Skvortsov/FE (RSA); Soichi Noguchi/FE (JAXA), T.J. Creamer/FE (USA), & Tracy Caldwell Dyson/FE (USA). |  |                 |   |  |     |  |   |

In JSC MCC, Carson Sparks/FDO (Flight Dynamics Officer) in foreground & Tom Schmidt/GPO (Guidance & Procedures Officer), in rear, working launch data updates one hour prior to launch.





# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-227 - STS-131/19A

| FLT NO.                     | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS                          | SSME-TL NOM-ABORT EMERG<br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br>AND ET | ORBIT<br>INC HA/HP   |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|-----------------------------|---------|--------------------------------------|---|---|--|--------------------|--|--|-----|---|--|
| STS-131/19A<br>Continued... |         |                                      |   | <br>S131E008710 |  |                    | AT LEFT:<br>S131-E-008710 -- Mastracchio (left) & Anderson conduct 2nd EVA during which they unhooked and removed depleted ammonia tank and installed a 1,700-pound ammonia tank on ISS Starboard 1 truss. Crew had problems with bolting down the new ATA tank on S1. They eventually got all 4 bolts secured, however, the time required to do this resulted in several tasks dropping off this EVA. |  |     | Continued...<br><br><b>EVENTS: Continued</b><br>- FD6&7: EVA2: Mastracchio & Anderson had difficulty installing new ATA onto S1 truss due to sticky plungers on bolt 4. Numerous workarounds were employed and eventually the bolt did cooperate. Alignment of the bolts and soft dock mechanisms are orientation sensitive and the task took much more time than booked. Several tasks were not completed & were rescheduled to EVA 3. EVA2 duration 7:26.<br>- FD9: EVA3: Mastracchio & Anderson completed: S1 ATA Fluid connectors (from EVA 2), Retrieve A/L MMOD shields (from EVA 2), Old ATA transfer to the LMC in Shuttle payload bay (all 4 bolts were engaged, though the last bolt required extra time due to some alignment challenges), & S1 ATA FGB install. EVA3 duration (PET) 6:24.<br>- FD9; Monday, April 12th celebrated the 49th Anniversary of the Soviet cosmonaut, Yuri Gagarin, first human to orbit the earth in 1961 and the 29th Anniversary of the first U.S. Space Shuttle launch in 1981.<br>- Transfers:<br>- 15,222 Lbs of hardware transferred to ISS (inside & out)<br>- 12,060 Lbs of MPLM supplies & logistics transferred to ISS<br>- 4,109 Lbs of MPLM supplies & logistics returned from ISS<br>- 1,702 Lb Ammonia Tank Assembly (ATA) delivered to ISS<br>- 1,295 Lb ATA (old) returned from ISS<br>- 94.5 Lbs of O <sub>2</sub> used to repress the stack<br>- 1,460 Lbs middeck items delivered to ISS<br>- 1,235 Lbs of middeck items returned from ISS to Discovery<br>- 6,639 Lbs of total hardware returned aboard Discovery<br>- 975 Lbs of water transferred to ISS<br><br>- 806,282 Mass (Lbs) of ISS now in space<br>- 98 Percentage complete of ISS assembly (pressurized volume)<br><br>- FD13: Undocked at 107:12:52:10Z<br><br>- During entry comm blackout times were approx 110/12:49:15 to 12:54:34 (~ 5.5 min). Early H/O to TDRS 46 was not an option as TDRS 46 stayed on a lower antenna. INCO prediction of LOS was in error due to DOL PAD error, noted in Significant Anomalies below. Also, see Ascent/Entry Flight Techniques Panel #255 of April 30, 2010.<br><br>Continued... |  |
|                             |         |                                      |   |                 |  |                    | S131-E-009456 --- Mastracchio (right) & Anderson conduct 3rd & final session of EVA. Activities included fluid lines hookup of new 1,700-pound ammonia tank and prepared cables on the Zenith 1 truss for a spare Space to Ground Ku-Band antenna.   |  |     |   |  |
|                             |         |                                      |   |   |  |                    |   |  |     |   |  |
|                             |         |                                      |   |   |  |                    | S131-E-007954 --- First time four women in space shown in the Zvezda Service Module: clockwise from lower left: are Tracy Caldwell Dyson/FE EXP 23, Metcalf-Lindenburger/MS, Yamazaki/MS(JAXA), & Wilson/MS.   |  |     |   |  |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM AND ET | ORBIT<br><br>INC HA/HP |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------|--------------------------------------|---|--|--|-----------------|------------------------|--|-----|--|---|
| STS-131/19A<br>Continued...   |         |                                      |   |  |  |                 |                        |  |     |  | <p>Continued...</p> <p><b>SIGNIFICANT ANOMALIES:</b></p> <p><u>Orbiter:</u></p> <ul style="list-style-type: none"> <li>- CCTV Camera C zoom not functioning</li> <li>- DURING STS-131, KU-BAND FAILED FROM POWER UP FOR BOTH COMM AND RADAR OPERATIONS.</li> <li>- NIRD 131-005, D-131-RPM-410-001: DEBRIS EVENT DURING ACCENT AT 42SEC MET FROM PORT UPPER RSB TRAILING EDGE. TILE HAS BROKEN AWAY, APPEARS TO BE PARTIAL LIBERATION. VISIBLE CHARRING ALONG THE AFT EDGE.</li> <li>- LRCS fuel helium ISO B valve slow to close during post wave off system reconfigure.</li> <li>- FRCS fuel helium ISO A valve slow to close during post entry valve test.</li> </ul> <p><u>KSC:</u></p> <ul style="list-style-type: none"> <li>- STS-131 Post Launch Debris</li> </ul> <p><u>SRB:</u></p> <ul style="list-style-type: none"> <li>- UPLOADED ACCELEROMETER DATA FROM THE S/N 2000003 DAS SHOWED 446 SECONDS OF PREFLIGHT TESTING FOLLOWED BY THE FIRST 94 SECONDS OF FLIGHT DATA</li> </ul> <p><u>RSRM:</u> None.</p> <p><u>SSME:</u></p> <ul style="list-style-type: none"> <li>- ME-2 HPFTP 21 DEGREE ACCEL DISQUALIFIED @ T+7:19</li> </ul> <p><u>ET:</u> None.</p> <p><u>MOD:</u></p> <ul style="list-style-type: none"> <li>- INCORRECT COMM PREDICTS DUE TO PADS ERROR</li> </ul> <p><u>Integration:</u></p> <ul style="list-style-type: none"> <li>- Base Heat Shield TPS Liberation</li> <li>- Windows 5, 6 Missing/Protruding Ceramic Plugs</li> <li>- Rudder Speedbrake TPS Liberation</li> </ul> |
| <div>  <p>ABOVE: JSC2010-E-045167 --- Flight Directors for the STS-131/19A: From the left are Tony Ceccacci, Bryan Lunney, Paul Dye, Richard Jones, Ginger Kerrick and Mike Sarafin.</p> <p>BELOW: JSC2010-E-051978 -- STS-131 Orbit 2 Flight Control Team pose in JSC MCC. FD Mike Sarafin holds mission logo.</p>  </div> <div>  <p>Discovery's planned approach and landing track across the continental U.S. Photo courtesy JSC/PAO.</p>  <p>SHUTTLE051109 049(KSC)--- Discovery on approach to KSC Runway 33 on April 20, 2010, after weather waveoffs on April 19th and again on first opportunity of April 20th.</p> </div> |         |                                      |   |  |  |                 |                        |  |     |  |   |


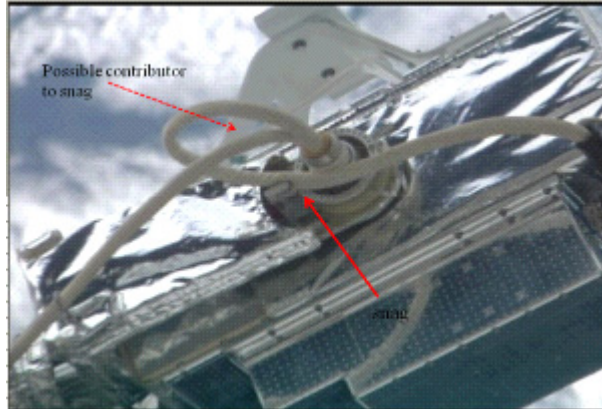
## Page 2-229 - STS-132/ULF4

[illegible]



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-230 - STS-132/ULF4


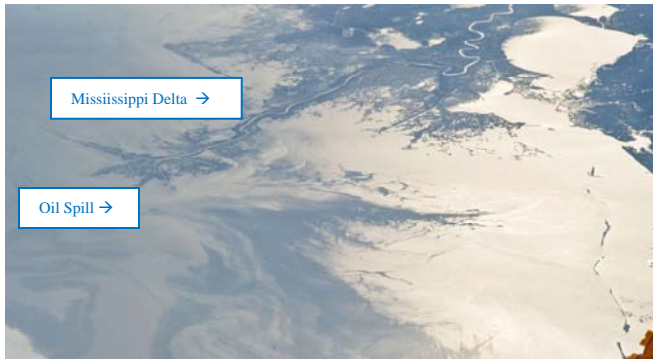

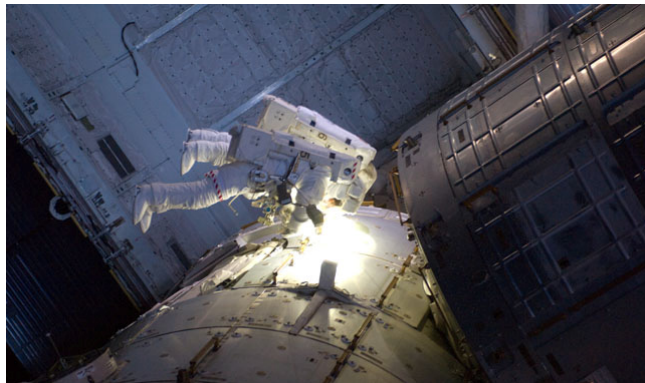
| FLT NO.                      | ORBITER | CREW (7)<br>TITLE, NAMES & EVA'S              | LAUNCH SITE,<br>LIFTOFF TIME,<br>LANDING SITES,<br>ABORT TIMES   | LANDING SITE/<br>RUNWAY,<br>CROSSRANGE<br>LANDING TIMES<br>FLT DURATION,<br>WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.                  | SRB<br>RSRM<br>AND<br>ET | ORBIT<br>INC HA/HP   |  | FSW  | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|------------------------------|---------|---|--|--|--|--------------------------|--|--|--|---|--|
| STS-132/ULF4<br>Continued... | OV-104  | Continued...<br><br>MCC WHITE FLIGHT FCR (62) | Continued...<br><br><u>SE TAL (ZZA 104):</u><br>6:02(P) 6:02(A)<br><br><u>PTM (U/S 181 FPS):</u><br>5:48(P) 5:59(A)<br><br><u>SE PRESS 104</u><br>6:51(P) 6:53 (A)<br><br><u>MECO CMD:</u><br>8:24.1 (P) 8:25.6 (A)<br><br><u>VI:</u><br>25819(P) 25819(A)<br><br><u>OMS-2:</u><br>37:47 (P) 38:15(A)<br>98.8(P) 97.4(A) FPS | Continued...<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u> 190 KEAS<br>146:12:48:10Z<br><br><u>NLGTD:</u> 6227 FT<br>146:12:48:19Z<br><u>VEL:</u> 135 KGS<br>141 KEAS<br><u>HDOT:</u> -5.0 FPS<br><br><u>BRK INIT:</u> 59 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u><br>57 KGS<br>146:12:48:47Z<br><br><u>BRK DECEL FPS²:</u><br>AVE 2.7 PK 4.1<br><br><u>WHEELS STOP:</u><br>146:12:49:27Z<br>12019 FT<br><br><u>ROLLOUT:</u><br>9100 FT<br>1:19 M:S<br><br><u>WINDS:</u><br>8 H KTS 2 L KTS<br><br><u>OFFICIAL:</u><br>31508P11 (X 3p4<br>HD 8p10)<br><br><u>DENS ALT:</u> 1652 FT<br><br><u>FLT DURATION:</u><br>11:18:27:59<br><br><u>S/T:</u><br>1277:09:03:11<br><br><u>OV-104:</u><br>294:18:27:11<br><br>Continued... |  |                          | <p>ABOVE: ISS023-E-050819 --- STS-132 (blue shirts) and Exp 23 crews (red shirts) on ISS. Front: Exp CDR Oleg Kotov/RSA (ctr lt), CDR Ham (ctr rt), with (from lt) T.J. Creamer/FE Exp 23, Good/MS, Alexander Skvortsov (RSA)/FE Exp 23, &amp; Reisman/MS. Back (from lt): Bowen/MS, Tracy Caldwell Dyson/FE Exp 23, Piers Sellers/MS, Mikhail Kornienko (RSA)/FE, PLT Antonelli, &amp; Soichi Noguchi (JAXA)/FE Exp 23.</p> <p>BELOW: --- While preparing for the routine inspection of Atlantis' TPS on FD2, crew discovered a pinched cable preventing the sensor package pan and tilt unit from moving properly. During EVA 2 the crew successfully unsnagged &amp; tied off cable. Photo courtesy K. Herring/PAO.</p> |  |  |   | Continued...<br><br><b>FIRSTS/LASTS:</b><br>- Last scheduled flight of Atlantis.<br>- The Mini Research Module 1 (MRM1), aka Rassvet, is first & only major piece of Russian H/W that U.S. hauled to ISS.<br>- First evaluation of Commercial Compression Garments to prevent post-spaceflight Orthostatic Intolerance .<br>- First RSRM incorporation of V1288 fluorocarbon O-rings in nozzle joints 4 and 5.<br><br><b>TENTH SHUTTLE CREWMEMBER REPLACEMENT</b><br>- Karen Nyberg (medical condition) was replaced by Michael Good in August 2009. (9th Shuttle crewmember replacement occurred on STS-118.)<br><br><b>NIGHT LAUNCH:</b> N/A<br><br><b>RENDEZVOUS:</b> #79 Rendezvous and dock with ISS.<br><br><b>EVENTS:</b><br>- Gerst:"The entire team gave us a great launch...nice ET... [only] one small piece of foam late in ascent."<br>- FD1: OMS2 ignition at 134:18:58:24Z resulted in a 125.1 by 85.2 NM orbit.<br>- FD2: During RCC surveys a camera cable was wedged between camera & OBSS structure limiting tilt capability. This left gaps in RCC survey. Ops team developed plan to get docked imagery and cable assess during EVA.[ <u>Post mission:</u> It was determined that the snag was attributed to cable S/N unique memory characteristics. Cable was replaced with a different S/N cable.]<br>- T1 maneuver at 136:11:40:09Z resulted in a 189.7 by184.8 NM orbit<br>- FD3: R-Bar Pitch Maneuver was performed.<br>- Docking Contact occurred at 136:14:28:25Z.<br>- Hard Dock, hooks closed, occurred at 136:14:40:49Z.<br>- ISS Hatch opened at 11:18 AM CDT May 16, 2010, welcomed by ISS crew.<br>- FD4: EVA 1: Reisman & Bowen installed SGANT & EOPT<br>EVA1 duration 7:25.<br>- FD5 Russian MRM1 successfully unberthed and docked to ISS.<br>- FD6: EVA2: Bowen & Good successfully completed all tasks: cleared cable from the Orbiter LDRI tilt axis, installed 4 new batteries in truss 3 old batteries into pallet, & stowed a temp. EVA2 duration 7:09.<br>- FD8: EVA 3: Good & Garrett activities included: completion of batteries R&R's, P6 cleanup, & PDGF trial. EVA3 duration (PET) 6:46.<br><br>Continued... |

ISS023E044569



Iss023e044569 -- Atlantis on 'Final Approach' to ISS with Russian MRM1.

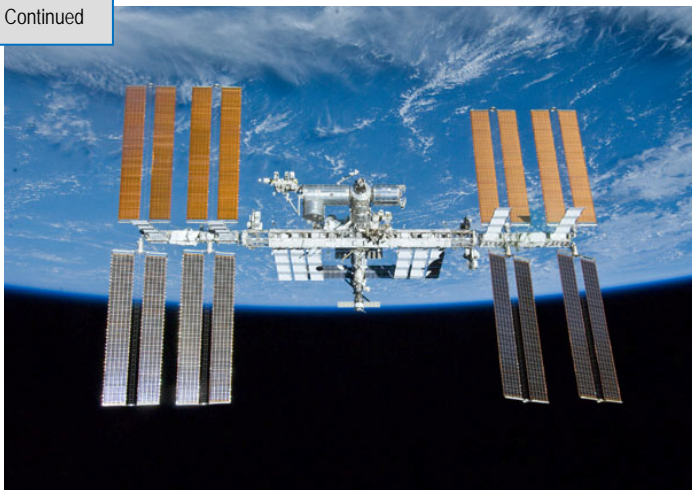






# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.                  | SRB<br>RSRM<br>AND<br>ET | ORBIT<br><br>INC<br>HA/HP |  | FSW | PAYLOAD WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|--------------------------------------|---|--|--|--------------------------|---------------------------|--|-----|---|--|
| STS-132/ULF4<br>Continued...   |         |                                      |   | Continued...<br><br>DISTANCE:<br>4,879,978 sm<br><br>TOTAL SHUTTLE<br>DISTANCE:<br>524,493,743 sm  |  |                          |                           |  |     | Continued...<br><br>EVENTS: Continued...<br>- Transfers:<br>- 28,792 Lbs H/W transferred to ISS (inside & out) includes MRM1 "Rassvet" - loaded (17,670 Lbs)<br>- 7,573 Lbs ICC with supplies to ISS<br>- 6,466 Lbs ICC with supplies from ISS<br>- 42 Lbs Oxygen to ISS<br>- 30 Lbs Oxygen to ISS (stack repress)<br>- 10.5 Lbs Nitrogen to ISS<br>- 1,325 Lbs water to ISS<br>- 2,192 Lbs middeck items to ISS aboard Atlantis<br>- 1,763 Lbs middeck items returned from ISS aboard Atlantis<br>- 8,229 Lbs total H/W returned aboard Atlantis includes ICC<br>- 816,349 Mass (Lbs) of ISS now in space<br>- Undocked at 143:15:22:04Z<br>- During entry comm outage time due to blackout was 146/12:32:00Z - 12:34:30Z (~ MET 011/18:12 - 18:14:30). S/W handover to TS 46 was not available as TS 46 was on a Lower Antenna resulting in plasma blackout. This was well advertised. At 12:34:30Z due to Roll Reversal, TS 46 satellite works over to upper antenna and regains comm. Comm through Mila was available at 12:36:00Z with hand down to Mila at 12:37:00Z. |  |
|   |         |                                      |   |   |  |                          |                           |  |     | Continued...  |  |
| LEFT: ISS023-E-032398 --- Soichi Noguchi (JAXA) ISS EXP 23 FE, photographed the Mississippi Delta showing the BP oil slick in the Gulf of Mexico on May 4, 2010. Part of the river delta and nearby Louisiana coast appear dark in the sunglint. Location of oil rig is out of frame to the left. USGS Comment: "Worst oil spill in U.S. history." |         |                                      |   | S132-E-008106 -- Bowen during first EVA with Reisman (out of frame), continues construction and maintenance on the ISS, with battery replacements & installation of a 2nd Ku-band antenna. |  |                          |                           |  |     |   | S132-E008900 -- Good (foreground) & Reisman, are surrounded by ISS hardware during the flight's final EVA.           |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2- 232 - STS-132/ULF4





| FLT NO.   |  | ORBITER   |  | Atlantis was named after the primary research vessel for the Woods Hole Oceanographic Institute in Massachusetts from 1930 to 1966. The two-masted, 460-ton ketch was the first U.S. vessel to be used for oceanographic research. Such research was considered to be one of the last bastions of the sailing vessel as steam-and-diesel-powered vessels dominated. [From STS-132 Press Kit by PAO] |  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |  |   |  |
|---|--|---|--|---|--|--|--|---|--|
| STS-132/ULF4<br>Continued   |  |   |  |   |  | Continued...   |  |   |  |
|   |  | Shuttle Legacy Mural - Hanging in LCC Firing Room at KSC                            |  |   |  | <b>SIGNIFICANT ANOMALIES:</b><br><u>Orbiter:</u><br>During Flight, a FES Shutdown Occurred While Operating on the Primary B Controller. Reference: MER-09<br><u>KSC:</u><br>- STS-132 Post Launch Debris<br><u>SRB:</u><br>- LEFT-HAND SRB FRUSTUM UPPER RIGHT BSM ROOM TEMPERATURE VULCANIZATION (RTV) 133 IS MISSING, MEASURING 5? LONG<br><u>RSRM:</u> None.<br><u>SSME:</u> None.<br><u>ET:</u><br>- STS-132/ET-136 FOAM LOSS ON THE +Z SIDE OF THE INTERTANK<br><u>MOD:</u> None.<br><u>Integration:</u><br>- Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)<br>- Ice Observed on the T-0 Umbilical at Retraction |  |   |  |
| S132-E-012208 -- Atlantis bids final farewell to ISS!   |  | ATLANTIS TRIBUTE: From Mike Leinbach/Launch Director/KSC                            |  |   |  |  |  |   |  |
| <p>ABOVE RIGHT: KSC-2010-4450 (<a href="http://mediaarchive.ksc.nasa.gov/index.cfm">http://mediaarchive.ksc.nasa.gov/index.cfm</a>). This Tribute Display features <i>Atlantis</i> soaring above the earth. <i>Atlantis</i> flew seven missions to space station Mir. In addition to its many assembly, construction, and resupply missions to the International Space Station, <i>Atlantis</i> also flew the last Hubble Space Telescope servicing mission on STS-125. The planet Venus represents the Magellan probe deployed during STS-30, and the planet Jupiter represents the Galileo probe deployed during STS-34. Threaded through the design are the mission patches for each of <i>Atlantis</i>'s flights. The inset photos illustrate various aspects of space shuttle processing as well as significant achievements such as the "glass cockpit" and the first shuttle docking with Mir during STS-71. The inset photo in the upper left corner shows a rainbow over <i>Atlantis</i> on Pad A and <i>Endeavour</i> on Pad B. <i>Endeavour</i> was the assigned vehicle had <i>Atlantis</i>'s STS-125 mission needed rescue, and this was the last time both launch pads were occupied simultaneously. The stars in the background represent the many people who have worked with <i>Atlantis</i> and their contributions to the vehicle's success.</p> |  |   |  |   |  |  |  |   |  |
|   |  |  |  |   |  |   |  |  |  |
|   |  | CONGRESS ALLOWS ATLANTIS TO FLY AGAIN - SEE STS-135                                 |  |   |  |  |  |   |  |
| <p>----- ATLANTIS NOW HEADS TO STS-335 RESCUE MISSION PREP THEN TO THE BARN/MUSEUM! -----</p> <p>"Space Shuttle Atlantis comes home to the Kennedy Space Center for the final time, 25 years, 32 flights, and more than 120 million miles traveled; the legacy of Atlantis, now in the history books," Commentator Josh Byerly remarked from his console in Houston. NASA Photos courtesy: Susan Phipps Multimedia Librarian/AP3 JSC</p>  |  |   |  |   |  |  |  |   |  |

| ----- SOME OF THE OPERATIONS SUPPORT TEAM -----   |                    |
|---|--------------------|
| FLT NO.   | ORBITER            |
| STS-132/ULF4<br>Continued...  | OV-104<br>Atlantis |
|   |                    |
| STS132-S-012 (14 May 2010) --- Secretary of Defense Dr. Robert M. Gates, right, NASA Associate Administrator for Space Operations William H. Gerstenmaier, center, and other NASA mission managers monitor the last scheduled launch of Space Shuttle Atlantis from Firing Room 4 at KSC. |                    |
|   |                    |
| JSC2010-E-086698 -- Orbit 1 FCT: Flight Director Mike Sarafin (center) on front row.  |                    |
|    |                    |
| JSC2010-E-086451-- Orbit 2 FCT: Flight Director Chris Edelen (second left) on front row.  |                    |
|   |                    |
| JSC2010-E-086504 -- Orbit 3 FCT: Flight Director Ginger Kerrick (right) holds mission logo.   |                    |
|    |                    |
| JSC2010-E-087358 -- Entry FCT Flight Director Tony Ceccacci holds mission logo.   |                    |
|   |                    |
| JSC2010-E-080436 --- Kyle J. Herring (left) & Joshua Byerly, both PAO commentators, on JSC MCC consoles during launch countdown.  |                    |
|   |                    |
| JSC2010-E-063832-- ISS FD's: Left (front row) Emily Nelson & Scott Stover. Back row: Royce Renfrew & Holly Ridings.   |                    |
|    |                    |
| JSC2010-E-045162 --- STS FD's: From left: Chris Edelen, Richard Jones, Mike Sarafin, Ginger Kerrick & Tony Ceccacci.  |                    |
|    |                    |
| JSC2010-E-090665-- Ascent FCT: FD Richard Jones (right) & STS-132 CDR Ken Ham hold the mission logo.  |                    |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-234 - STS-133

| FLT NO.   | ORBITER   | CREW (6)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.   | SRB<br>RSRM<br>AND<br>ET  | ORBIT   |   | FSW  | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|---|--|--|--|---|---|---|---|--|---|--|
| STS-133/ULF5<br><br>SEQ<br>FLT # 133<br><br>KSC-133<br><br>PAD 39A (56)<br><br>MLP-3<br><br>35th<br>SHUTTLE<br>FLIGHT<br>TO ISS | OV-103 (Flight 39)<br><br>Discovery's<br>LAST<br>FLIGHT<br><br>OMS PODS<br>LPO1 -42<br>RPO3-40<br>FRC3-39 | CDR:<br>Steven W. Lindsey<br>(Flt 5 - STS-87, STS-95,<br>STS-104, STS-121)<br>P836/R229/V131/M200<br><br>PLT<br>Eric A. Boe<br>(Flt 2 - STS-126)<br>P837/R331/V 221/M286<br><br>MS 1<br>Alvin Drew<br>(Flt 2 STS-118)<br>P838/R314/V221/M270<br><br>MS 2<br>Steve Bowen<br>(Flt 3 - STS-126, STS-131)<br>P839/R332/V220M287<br><br>MS 3<br>Michael Barratt<br>(TMA-14 ISS EXP 19 & 20)<br>P840/R355/M306<br><br>MS 4<br>Nicole Stott<br>(Flt 2 - Up STS-128 stay ISS<br>Dn STS-129)<br>P841/R347/V223/F47<br><br>SPECIAL PASSENGER<br>Robonaut 2<br>First dexterious humanoid<br>robot in space - stay ISS<br><br>Continued... | KSC 39A<br>055:21:53:24Z<br>4:50:27 PM EST (P)<br>4:53:24 PM EST (A)<br>Thursday (35)<br>02/24/11 (11)<br><br>LAUNCH WINDOW:<br>6M 02S (Total)<br>3M02S (Preferred)<br><br>EOM PLS: KSC<br>TAL: ZZA<br>TAL WX: MRN ,<br>FMI<br><br>SELECTED:<br>RTLS: KSC15 C/N<br>TAL: ZZA30 C/N<br>AOA: KSC15 C/N<br>1ST DAY PLS<br>EDW22 C/N (Briefed<br>to crew)<br>KSC15 C/N (Go Wx)<br><br>TDEL:<br>0.000 (P) 0.092 (A)<br><br>MAX Q NAV:<br>714.8 (P) 710.4 (A)<br><br>SRB STG:<br>2:05.9 (P) 2:06.9 (A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN):<br>2:41 (P) 2:44 (A)<br><br>NEG MRN (2@ 104):<br>3:54(P) 3:56(A)<br><br>PTA (U/S 160 FPS):<br>5:24(P) 5:15(A)<br><br>Continued... | KSC15 KSC (76)<br>068:16:57:15Z<br>10:57:15 AM CST<br>Wednesday (17)<br>03/09/11 (11)<br><br>DEORBIT BURN:<br>068:15:52:04Z<br><br>X RANGE: 24.8 NM<br><br>ORBIT DIR: A/R (15)<br>AIM PT: Close-In<br><br>MLGTD: 2446 FT<br>068:16:57:15Z<br>VEL: 180 KGS<br>197 KEAS<br>HDOT: -1.4 FPS<br><br>TD NORM 195:<br>2645 FT<br>Continued... | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/104.5/<br>72/104.5<br><br>ACTUAL:<br>100/104.5/72/<br>104.5<br><br>1 = 2044 (13)<br>2 = 2048 (9)<br>3 = 2058 (5)<br><br>M 3 EOM:<br>WEIGHT:<br>205011 LBS<br>X CG:<br>1082.4 IN<br>LANDING:<br>WEIGHT:<br>205022 LBS<br>X CG: 1084.3 IN | BI-144<br><br>RSRM<br>112<br><br>ET-137<br>SLWT 41<br>w/Stringer<br>Mod<br><br>ET<br>IMPACT<br>1:14:20<br>MET<br><br>LAT:<br>35.535S<br><br>LONG:<br>158.000W | 51.6<br>(35)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2<br>125.5x84.9 NM<br><br>DEORBIT<br>HA 192.9 NM<br>HP 23.2 NM<br><br>ENTRY<br>VELOCITY:<br>25868 FPS<br><br>ENTRY<br>RANGE:<br>4387 NM | OI-34<br>(6)<br><br>CARGO:<br>40108 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>31802 LBS<br><br>DEPLOYED:<br>30576 LBS<br><br>NON-DEPLOYED:<br>818 LBS<br><br>MIDDECK:<br>408 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1729240 LBS<br><br>NON-DEPLOYED:<br>1629277 6LBS<br><br>CARGO TOTAL:<br>4326516 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 2821<br>FUEL BIAS: 954<br>FINAL TDDP: 1481<br>RECON: 394<br><br>PAYLOADS:<br>PLB: ISS-ULF 5<br>(ELC 4,PMM),<br>LWAPA<br><br>MIDDECK:<br>ISS-ULF 5, MAUI,<br>SEITE, SIMPLEX,<br>RAMBO-2<br><br>4 CRYO TANK<br>SETS, ODS,<br>SRMS (89),<br>OBSS, SSPTS | <b>Brief Mission Summary:</b> The STS-133 (35th mission to ISS) delivered two key components to ISS – the Italian-built Permanent Multipurpose Module (PMM) and Express Logistics Carrier 4 (ELC4) – for spare parts and storage capacity. Also delivered was Robonaut 2, the first dexterous humanoid robot in space. <i>This was the final flight of the most flown Orbiter, Discovery (39 flights) - The Beginning of the END!</i><br><br><b>KSC W/D</b><br>OPF: 138 days + 3 holidays<br>VAB HB3 (part 1):10 days + 2 contingency days<br>PAD A (part 1): 82 days + 8 contingency days = 2 holidays (rolled back for ET repairs)<br>VAB (part 2): 35 days + 5 holidays<br>PAD A (part 2): 19 days + 5 contingency<br>Total Work Days = 284 (OPF processing occurred over a total time period of 141 days)<br><br><b>POSTPONEMENTS:</b><br>- Baseline STS-133 to FDRD - launch date of 07/29/10 on 06/30/09.<br>- Ppd. to 09/16/10 on 09/30/09. Adjustments needed for flight product planning.<br>- Ppd to 11/01/10 on 07/01/10. Slip was required to complete preparations of critical spares that will be launched in the Permanent Multi-Purpose Module (PMM).<br><br><b>LAUNCH SCRUBS:</b> - Launch scrubbed on 10/29/10 due to helium & nitrogen leaks discovered in the right OMS pod. Launch rescheduled for 11/02/10. On 10/30/10 launch rescheduled to 11/03/10 to allow additional time for reloading the helium tank after repair in the right OMS pod. Technical scrub.<br>- Launch scrubbed on 11/02/10 at L-1 MMT meeting due to problem with center SSME controller. Launch rescheduled for 11/04/10. Technical scrub.<br>- Launch scrubbed on 11/04/10 at tanking MMT meeting due to predictions of bad weather. Launch rescheduled for 11/05/10. Weather scrub.<br>- Launch scrubbed on Friday, 11/05/10 when a liquid hydrogen leak was detected about 6:30 a.m. CDT in the Ground Umbilical Carrier Plate (GUCP). Mike Moses, MMT Chair stated: "This is not a stranger to us – we saw this on STS-119 and STS-127." In addition to the leak, a crack was detected on the flange of the ET intertank near the oxygen tank. To allow time for engineering analyses of these issues, for compatibility with on orbit sun angles, and for avoidance of other space traffic to/from ISS, the launch was reset for NET 11/30/10.<br><br>Continued... |   |  |
|   |   |  |  |  |   |   |   |   |  |   |  |
|   |   |  |  |  |   |   |   |   |  |   |  |
|   |   |  |  |  |   |   |   |   |  |   |  |
| Delivered to ISS on STS-133. Flight Controllers successfully “awakened” Robonaut 2 on August 23, 2011.                          |   |  |  |  |   |   |   |   |  |   |  |
|   |   |   |  |  |   |   |   |   |  |   |  |
|   |   | <b>Giant Crawler Carries Shuttle To Pad</b><br>ABOVE: STS-133 rolls to PAD on 09/20/10 for first launch attempt - scrubbed on 10/29/10. The KSC crawler-transporters (two) carried all Apollo Saturn V's and all Shuttle vehicles on the gravel path from the VAB to Launch Complex 39.  |  |  |   |   |   |   |  |   |  |



ROBONAUT 2

Delivered to ISS on STS-133. Flight Controllers successfully "awakened" Robonaut 2 on August 23, 2011.





## Giant Crawler Carries Shuttle To Pad

ABOVE: STS-133 rolls to PAD on 09/20/10 for first launch attempt - scrubbed on 10/29/10. The KSC crawler-transporters (two) carried all Apollo Saturn V's and all Shuttle vehicles on the gravel path from the VAB to Launch Complex 39.

# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-235 - STS-133

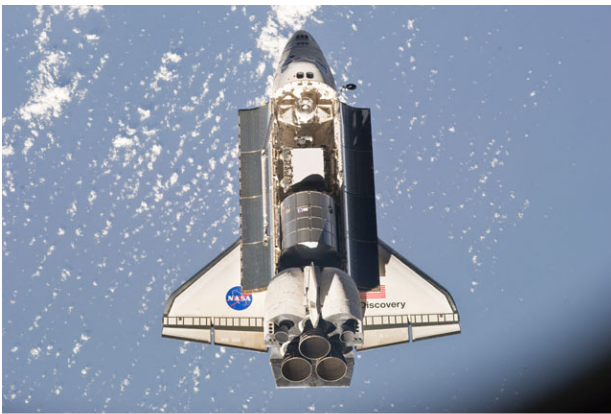



| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME,   | LANDING SITE/ RUNWAY, CROSSRANGE   | SSME-TL NOM-ABORT EMERG  | SRB RSRM | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |  |              |
|--|---------|--|--|--|--|----------|-------|--|-----|--|---|--|--------------|
| STS-133/ULF5   | OV-103  | Continued...<br><br>SS EVA 157<br>DOCKED QUEST EVA 75<br>EMU/TETHERED EVA 150<br>SCHEDULED EVA 148<br>DURATION 6:34<br><br>SS EVA 158<br>DOCKED QUEST EVA 76<br>EMU/TETHERED EVA 151<br>SCHEDULED EVA 149<br>DURATION 6:14   | Continued...<br><br><u>SE TAL (ZZA 104):</u><br>6:03(P) 6:01(A)<br><br><u>PTM (U/S 180 FPS):</u><br>6:25(P) 6:28(A)<br><br><u>SE PRESS 104</u><br>6:58(P) 7:00 (A)<br><br><u>MECO CMD:</u><br>8:22.6 (P) 8:23.8 (A)<br><u>VI:</u><br>25819(P) 25818(A)<br><br><u>OMS-2:</u><br>37:46 (P) 38:30(A)<br>98.8(P) 96.4(A) FPS | Continued...<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u> 191 KEAS<br>068:16:57:18Z<br><br><u>NLGTD:</u> 5439 FT<br>68:16:57:26Z<br>VEL: 129 KGS<br>141 KEAS<br>HDOT: -6.2 FPS<br><br><u>BRK INIT:</u> 56 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u><br>58 KGS<br>68:16:57:47Z<br><br><u>BRK DECEL FPS<sup>2</sup>:</u><br>AVE 4.4 PK 6.3<br><br><u>WHEELS STOP:</u><br>68:16:58:11Z<br>9641 FT<br><br><u>ROLLOUT:</u><br>7195 FT<br>0:56 M:S<br><br><u>WINDS:</u><br>18 H KTS 2 L KTS | <div>DISCOVERY'S FINAL LIFT-OFF</div>  |          |       |  |     | Continued...                           |   |  |              |
| <u>CAPCOMS:</u><br><u>SHUTTLE</u><br>Asc - Charlie Hobaugh<br>- Barry Wilmore (Wx)<br>LD/O1 - Steve Robinson<br>O2 - Megan McArthur<br>Planning - Mike<br>Massimino<br>Ent - Charlie Hobaugh<br>- Terry Virts (Wx)<br>Team 4 - N/A<br><u>ISS</u><br>O1 - Hal Getzelman<br>LD/O2 - Stan Love<br>O3 - Ricky Arnold<br>Team 4 - N/A |         | MCC WHITE FLIGHT FCR (63)<br><u>FLIGHT DIRECTORS:</u><br><u>SHUTTLE:</u><br>Ascent- Richard Jones<br>LD/O1 - Bryan Lunney<br>O2- Ginger Kerrick<br>O3 - Rick LaBrode<br>Entry - Tony Ceccacci<br>MOD – John Mccullough<br>Team 4 & Prelaunch:<br>- Paul Dye<br><u>ISS</u><br>O1 - David Korth<br>LD/O2 - Royce Renfrew<br>O3 - Chris Edelen<br>Team 4 - Kwatsi Alibaruho | <div>STS133-S-039 (24 Feb. 2011)</div>    |  |  |          |       | Continued...   |     |  |   |  |              |
| External Tank Foam Loss 3 min, 51 sec into Ascent<br>- No Severe Damage  |         |  | <div>Official:<br/>15018P25KT<br/>(X2P2H18P25)<br/><br/>DENS ALT: 1266 FT<br/><br/>FLT DURATION:<br/>12:19:03:53<br/><br/>S/T:<br/>1290:04:07:04<br/><br/>OV-103:<br/>359: 22: 24:02<br/><br/>Continued...</div>   |  |  |          |       | <div>PRCB Briefing Chart for ET-137 Intertank Stringer Crack Issue found after fourth launch scrub on 11/05/10 when a liquid hydrogen leak was detected.</div> |     |  |   |  | Continued... |







PRCB Briefing Chart for ET-137 Intertank Stringer Crack Issue found after fourth launch scrub on 11/05/10 when a liquid hydrogen leak was detected.



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (7)             | LAUNCH SITE, LIFTOFF TIME,   | LANDING SITE/ RUNWAY, CROSSRANGE  | SSME-TL NOM-ABORT EMERG    | SRB RSRM  | ORBIT |       | FSW  | PAYLOAD WEIGHTS,      | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS,                         |
|---|---------|----------------------|--|-----------------------------------|----------------------------|---|-------|-------|--|-----------------------|---|
| STS-133/ULF5  |         | TITLE, NAMES & EVA'S | LANDING SITES, ABORT TIMES   | LANDING TIMES FLT DURATION, WINDS | THROTTLE PROFILE ENG. S.N. | AND ET  | INC   | HA/HP |  | PAYLOADS/ EXPERIMENTS | TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
| <br>ISS026E030282 |         |                      | Continued...<br><u>DISTANCE:</u><br>5,304,140 sm<br><br><u>TOTAL OV-103 DISTANCE</u><br>148,221,675 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>529,797,883 sm |                                   |                            | <br>S133-E-007808 --- ISS's Canadarm2 grasps the Italian-built Permanent Multipurpose Module (PMM) for transfer from Discovery's payload bay to be permanently attached to the Unity node.  |       |       | Continued...<br><u>FIRSTS/LASTS:</u><br>- Last flight of Discovery - 1st vehicle to be retired.<br>- Robonaut 2 is first dexterous humanoid robot in space<br>- First flight of SRB Thrust Vector Control (TVC) Auxiliary Power Unit (APU) Phase II fuel pump<br>- All six existing major spacecraft from Japan, Europe, Russia and the US that service ISS were simultaneously docked for first and last time. (Proposed Soyuz fly around of ISS for historic photo of the 6 vehicles - ruled out by Russia's FSA as safety risk.)<br>- Last NASA module (Italian-built), the Permanent Multipurpose Module (PMM), a storage room, was attached to ISS.<br>- Steve Bowen is first NASA astronaut to fly on back-to-back Shuttle missions (see below).<br>- FD13: First "Live" Wakeup Call! Performed by Big Head Todd & the Monsters playing "Blue Sky" from MCC, Tuesday, March 8, at 3:23 a.m. CST.<br><br><u>11th SHUTTLE CREWMEMBER REPLACEMENT</u><br>- Tim Kopra (injury) was replaced by Bowen in Jan. 2011. (10th Shuttle crewmember replacement occurred on STS-132..)<br><br><u>NIGHT LAUNCH:</u> N/A<br><br><u>RENDEZVOUS: #80</u> Rendezvous and dock with ISS.<br><br><u>EVE NTS:</u><br>- FD1: OMS2 ignition at 55:22:31:54Z resulted in a 125.5 by 84.9 NM orbit.<br>- FD2: No Focus Inspection required for TPS/RCC<br>- T1 maneuver at 57:16:33:24Z resulted in a 192.4 by 184.9 NM orbit.<br>- FD3: Performed R-Bar Pitch Maneuver.<br>- Docking Contact occurred at 057:19:14:18Z<br>- Hard Dock, hooks closed, occurred at 057:20:04:09Z<br>- ISS Hatch opened at 3:16 PM CST Feb. 26, 2011.<br>- Reboost (26 mins) at 62:14:29:36Z resulted in a 194.6 by 184.8 NM orbit.<br>- FD5: EVA 1: Bowen & Drew completed all planned tasks: J612 extension cable install, Pump module retrieval from POA, Pump module install on ESP-2, CP3 camera wedge install, and Message in a Bottle Experiment. During pump installation task the cupola robotic workstation had a "loss of comm." resulting in Bowen holding the 800 lb (but now weightless) pump for 25 min. He reported "I'm fine as long as it's not too much longer." Then added "How much longer?" Operations were transferred to the Lab robotics and task completed. EVA1 duration 6:34<br>Continued... |                       |   |
| <br>S133E007375  |         |                      | S133-E-007375 --- Bowen (top) and Drew, conduct EVA 1 as construction and maintenance continues on ISS.  |                                   |                            | <br>S133-E-008627 --- In U.S. Lab Destiny, crews pose for a joint STS-133/Exp 26 group portrait. The STS-133 crew in red shirts (from left) are Stott, Drew, PLT Boe, CDR Lindsey, Barratt & Bowen. In dark blue Exp 26 crew, from left, are Paolo Nespoli/ESA, Oleg Skripochka/RSA, Dmitry Kondratyev/RSA (below), Alexander Y. Kaleri/ RSA and CDR Scott Kelly and Cady Coleman (below). |       |       |  |                       |   |

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES | LANDING SITE/ RUNWAY, CROSSRANGE | SSME-TL NOM-ABORT EMERG | SRB RSRM | ORBIT |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|--------------------------------------|--|----------------------------------|-------------------------|----------|-------|--|-----|--|---|
| <div><div><div><p>S133E007866</p><p>S133-E-007866 --- CDRs Scott Kelly (left) Exp 26 &amp; Steve Lindsey STS-133 are shown in the hatch leading to the newly-installed PMM.</p></div><div><p>Discovery's planned final approach and landing track to KSC. Chart courtesy Kyle Herring/JSC-PAO.</p></div></div><div><div><p>STS-133/ULF5 Discovery departs ISS for last time!</p></div><div></div></div><div><p>Continued...</p><p><b>EVE NTS: (Continued)</b></p><ul style="list-style-type: none"><li>- FD5 MMT Decision: Based on FD2 inspection and RPM data, the TPS was cleared for entry per Flight Rule A2-142</li><li>- FD6: PMM, an extra storage room/closet, was installed and hatch opened.</li><li>- FD7: EVA2: Bowen &amp; Drew successfully completed all tasks: Vent Ops/OD bag cleanup, Light Weight Adapter Plate Assembly (LWAPA) Retrieval &amp; Install, P3 CETA Light Install, SPDMM Camera Light Pan/Tilt Assy 1 Install and EP1 MLI Removal, and P1 Grapple Beam re-torque bolts down, plus several get-aheads. EVA2 duration 6:14.</li><li>- Transfers:<ul style="list-style-type: none"><li>31,459 Pounds of H/W to ISS (inside &amp; out)</li><li>110 Pounds of Oxygen to ISS (Quest tanks)</li><li>72 Pounds of Oxygen to ISS (stack repress)</li><li>26 Pounds of Nitrogen to ISS</li><li>931 Pounds of water to ISS</li><li>2,031 Pounds of middeck items to ISS</li><li>2,599 Pounds of H/W (middeck only) returned to Discovery</li></ul></li><li>- ISS Mass in space 919,964 Pounds</li><li>- 100 Percent ISS complete ( pressurized volume)</li><li>- FD12: Undock from ISS complete at 066:12:00:10Z</li><li>- FD14: During entry comm outage times due to blackout were:<ul style="list-style-type: none"><li>- 1st outage 068:16:39:25Z. INCO cmds H/O from TDRS 174 to TDRS 46 prior to roll cmd - at 068:16:30:25Z 1st outage ends.</li><li>- 2nd outage at 068:16:37:53Z. INCO cmds H/O back to TDRS 174 prior to 1st roll reversal - at 068:16:37:58Z 2nd outage ends.</li></ul></li></ul><p>MILA AOS at 68:16:45:00Z good return link and UHF.</p><p><b>SIGNIFICANT ANOMALIES:</b></p><p><u>Orbiter</u></p><ul style="list-style-type: none"><li>- TPS Anomalies</li><li>- ATVC Ch 1 Power Supply Failed to Restart</li><li>- Ammonia Spray Boiler Sys B Unexpected Switchover</li><li>- KSC, RSRM, SSME, MOD, SRB - None.</li><li>- VIDEO FROM RH ET OBSERVATION CAMERA NOT RECORDED BY DAS DURING FLIGHT</li></ul><p><u>ET: (See Integration issues below)</u></p><p><u>Integration:</u></p><ul style="list-style-type: none"><li>- ET Intertank Stringer Cracks</li><li>- Hydrogen Leak at ET Ground Umbilical Carrier Plate (GUCP)</li><li>- Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)</li><li>- Debris Released From LH2 Flange Area Near the Bipod</li></ul></div><div><p><b>DISCOVERY'S FLAWLESS FINALE</b><br/><b>MLGTD @ KSC March 09, 2011, 10:57:15 CST</b><br/>201103090001HQ. - Courtesy: Rob Navias/JSC-PAO</p></div></div> |         |                                      |  |                                  |                         |          |       |  |     |  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-238 - STS-133

|                         |                   |   |  |
|-------------------------|-------------------|---|--|
| FLT NO.<br>STS-133/ULF5 | ORBITER<br>OV-103 | ----- SOME OF THE OPERATIONS SUPPORT TEAM ----- |  |
|-------------------------|-------------------|---|--|



JSC2011-E-021930 - STS-133 Lead FD Bryan Lunney monitors rendezvous data. His last flight.



JSC2011-E-023001 --- STS-133 Orbit 1 FCT - Flight Director Bryan Lunney (center left) on 2nd row.



Jsc2011e023002 --- ISS Orbit 3 FCT - Orbit 3 - FD Chris Edelen (lt) & CAPCOM Richard Arnold with STS-133 logo.

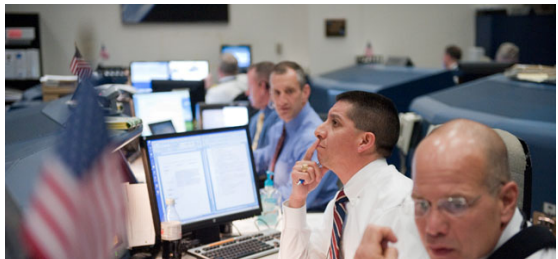
Pat Rvan/PAO



Ginger Kerrick/FD O2



JSC2011-E-024279 --- STS-133 Ascent and Entry FCT in shuttle FCR in JSC. Flight Directors Tony Ceccacci (left) and Richard Jones hold the STS-133 mission logo.



JSC2011-E- 021648 -- Rt to Lt: FDs Tony Ceccacci & Richard Jones, & CAPCOMs Charlie Hobaugh & Barry Wilmore.



IN KSC LCC: ABOVE: NASA Ctr Directors: (lt to rt) are Patrick Scheuermann/Stennis, Bob Cabana/KSC, Mike Coats/JSC, & Robert Lightfoot/MSFC. BELOW: We have lift-off! (lt to rt) Stephanie Stilson/Discovery Flow Director, Charlie Blackell-Thompson/Lead Test Director, & Mike Leinbach/ Launch Director.





## ----- SALUTE -----

### STS-133/ULF5 "A MIXTURE OF SADNESS AND PRIDE"

JSC Center Director: "I am proud to have been the Pilot on the first flight of Discovery in 1984. I also flew Discovery on my two missions as Commander." - Mike Coats

Shuttle Program Manager/JSC: "Discovery's landing yesterday was an outstanding end to an amazing mission. I was really struck by the "business as usual" attitude of the dedicated team that takes care of our Orbiters. ... To those team members that have flown their last flight with us - You should walk away with your head held very high. You have built and kept safe a unique capability in the most extreme of environments. I can only hope that others that come after us will look back at the Space Shuttle team and emulate the dedication, perseverance, and excellence that this team represents. If they do, we will have an outstanding human spaceflight program. For those team members remaining - Let's go finish this program strong." - John Shannon

STS-133 Crew: Nearing the end of the shuttle's final mission, the crew sentiments were a mixture of sadness and pride. "When you look out the Cupola window, times like that, I really reflect on what a great vehicle it's been - 39 missions, nearly one year on orbit, thinking about all the things the vehicle has done, it's kind of bittersweet." And later, "Houston for the last time, Wheels Stop!" - CDR Steve Lindsey.

"She retires with all of the honors and dignity due any of those ships that made great discoveries. So I think we salute Discovery in that way, with all the accolades she deserves. But it also lays out a challenge. What will be the next ship named Discovery? The next ship to bear this name hopefully will go farther than this one and make every bit as much of a contribution to history and to discovery as this ship." - Michael Barratt/MS

Launch Director/KSC: "I'm going to take away the attitude of the team on the ground that saved the vehicle. They did that today just like they've done every mission. They didn't skip a beat today and that's a true testament to their work ethic. It was heartwarming. ... Proud of the people that put the vehicle together and the flight controllers in Houston that executed the mission." - Mike Leinbach

Lead Flight Director/JSC: "Discovery represents the ingenuity, creativity and diligence of the teams who originally designed and built Discovery and also the teams who operated and evolved the capabilities of Discovery across three decades. Discovery evolved from a short duration LEO delivery vehicle to a much more capable delivery and service spacecraft staying on orbit more than twice as long as originally intended. The engineering teams and operations teams expanded Discovery's capabilities well beyond the original designers intentions enabling scientists to learn more and more about the world and universe around us." - Bryan Lunney/Onyx Flight

NASA Assoc Admin. for Space Ops: "I don't really know what to say other than to thank the Discovery team. I think of all the processing work, the folks throughout the history of this vehicle back to Downey and Palmdale who gave us a phenomenal vehicle. It's legacy is the future with station in great shape and that's only possible because Discovery performed so well. That extra work sets up so well for the research period aboard station." - Gerst

DISCOVERY NOW HEADS TO THE SMITHSONIAN NATIONAL AIR AND SPACE MUSEUM's UDVAR-HAZY CENTER IN CHANTILLY, VA.

### Shuttle Legacy Mural - Hanging in LCC Firing Room at KSC



### DISCOVERY TRIBUTE: From Mike Leinbach/Launch Director/KSC

KSC-2010-4453 (<http://mediaarchive.ksc.nasa.gov/index.cfm>). This Tribute Display features Discovery demonstrating the renowned Rendezvous Pitch Maneuver on approach to the International Space Station (ISS) during STS-114. Having accumulated the most space shuttle flights, Discovery's 39 mission patches are shown encircling the vehicle. The background image was taken from the Hubble Space Telescope, which was launched aboard Discovery on STS-31 and serviced by Discovery on STS-82 and STS-103. The prominent American flag and eagle represent Discovery's two "Return to Flight" missions, STS-26 and STS-114, and symbolize Discovery's heroic role in returning American astronauts to spaceflight. Discovery's significant accomplishments include the first female Shuttle pilot (Eileen Collins on STS-63), John Glenn's legendary STS-95 mission, and the celebration of the 100th space shuttle mission with STS-92. In addition, Discovery supported numerous DOD programs, satellite deploy/repair missions, and 13 flights for construction and operation of the ISS.



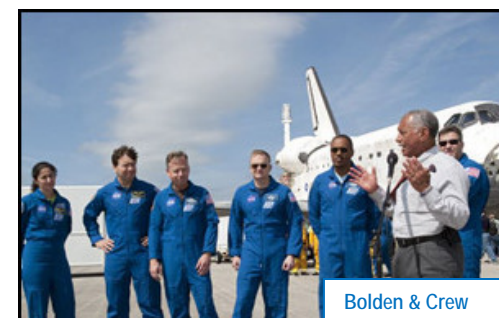
Cabana &amp; Crew



Leinbach &amp; Stott



Gerst - Lindsey - Moses






Bolden &amp; Crew




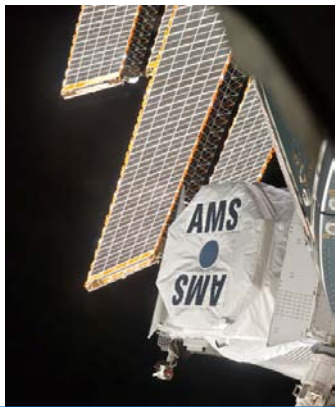


# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-240 - STS-134

| FLT NO.   | ORBITER  | CREW (6)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE, LANDING TIMES FLT DURATION, WINDS  | SSME-TL NOM-ABORT EMERG THROTTLE PROFILE ENG. S.N.   | SRB RSRM AND ET   | ORBIT  |   | FSW   | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|---|--|--|---|--|--|---|--|---|---|--|---|
| STS-134/ULF6<br><br>SEQ FLT # 134<br><br>KSC-134<br><br>PAD 39A (57)<br><br>MLP-2<br><br>36th SHUTTLE FLIGHT TO ISS   | OV-105 (Flight 25)<br><b>ENDEAVOUR FINAL FLIGHT</b><br><br><u>OMS PODS</u><br>LPO3 -35<br>RPO4 -31<br>FRC5 -24<br><br><u>MS 1</u><br>Michael Finke (ISS EXP 9 & 19)<br>P844/R356/M307<br><br><u>MS 2</u><br>Greg Chamitoff (Flt 2 UP ON STS-124, stay ISS, DN ON STS-126)<br>P845/R330/V225/M285 | <u>CDR:</u><br>Mark E. Kelly (Flt 4 - STS-124, STS-108, STS-121)<br>P842/R271/V181/M237<br><br><u>PLT</u><br>Gregory H. Johnson (Flt 2 - STS-123)<br>P843/R322/V224/M278<br><br><u>MS 1</u><br>Michael Finke (ISS EXP 9 & 19)<br>P844/R356/M307<br><br><u>MS 2</u><br>Greg Chamitoff (Flt 2 UP ON STS-124, stay ISS, DN ON STS-126)<br>P845/R330/V225/M285 | KSC 39A<br>136:12:56:28Z<br>8:56:28 AM EDT (P)<br>8:55:42 AM EDT (A)<br>Monday (18)<br>05/16/11 (10)<br><br><u>LAUNCH WINDOW:</u><br>5M 46S (Total)<br>5M01S (Preferred)<br><br><u>EOM PLS:</u> KSC<br><u>TAL:</u> ZZA<br><u>TAL WX:</u> MRN , FMI<br><br><u>SELECTED:</u><br><u>RTL:</u> KSC15 N/N<br><u>TAL:</u> ZZA30L N/N<br><u>AOA:</u> NOR17 N/N<br><u>1<sup>ST</sup> DAY PLS</u> EDW22 N/N<br><br><u>TDEL:</u><br>0.000 (P) 0.122 (A)<br><br><u>MAX Q NAV:</u><br>733.5 (P) 733.1 (A)<br><br><u>SRB STG:</u><br>2:04.8 (P) 2:04.8 (A)<br><br><u>PERF:</u> NOMINAL<br><br><u>2 ENG TAL (MRN):</u><br>2:36 (P) 2:36 (A)<br><br><u>NEG RET (2@ 104):</u><br>3:53(P) 3:54(A)<br><br><u>PTA (U/S 156 FPS):</u><br>5:00(P) 4:57(A)<br><br>Continued... | KSC15 KSC (77)<br>152:06:34:50Z<br>01:34:50 AM CDT<br>Wednesday (18)<br>06/01/11 (9)<br><br><u>DEORBIT BURN:</u><br>152:05:29:03Z<br><br><u>XRANGE:</u> 141.1 NM<br><br><u>ORBIT DIR:</u> A/L (46)<br><u>AIM PT:</u> Nominal<br><br><u>MLGTD:</u> 3138 FT<br>152:06:34:50Z<br>VEL: 196 KGS<br>191 KEAS<br>HDOT: -1.0 FPS<br><br><u>TD NORM 195:</u><br>2931 FT<br>Continued... | 104/104/<br>109%<br><br><u>PREDICTED:</u><br>100/104.5/104.5/<br>72/104.5<br><br><u>ACTUAL:</u><br>100/104.5/72/<br>104.5<br><br><u>M 3 EOM:</u><br><u>WEIGHT:</u><br>204532 LBS<br><u>X CG:</u><br>1080.4 IN<br><u>LANDING:</u><br><u>WEIGHT:</u><br>204463 LBS<br><u>X CG:</u> 1082.3 IN | BI-145<br><br>RSRM-113<br><br>ET-122<br>SLWT 42 w/Stringer Mod<br><br><u>ET IMPACT</u><br>1:14:11 MET<br><br><u>LAT:</u><br>36.436S<br><br><u>LONG:</u><br>158.531W | 51.6 (36)<br>DIRECT INSERTION<br><br><u>POST OMS-2</u><br>175.9x124.7 NM<br><br><u>DEORBIT</u><br>HA 188.7 NM<br>HP 23.1 NM<br><br><u>ENTRY VELOCITY:</u><br>25860 FPS<br><br><u>ENTRY RANGE:</u><br>4419 NM | OI-34 (6)<br><br><u>CARGO:</u><br>39210 LBS<br><br><u>PAYLOAD CHARGEABLE:</u><br>31693 LBS<br><br><u>DEPLOYED:</u><br>30721 LBS<br><br><u>NON-DEPLOYED:</u><br>811 LBS<br><br><u>MIDDECK:</u><br>161 LBS<br><br><u>SHUTTLE ACCUMULATED WEIGHTS:</u><br><u>DEPLOYED:</u><br>1759961 LBS<br><br><u>NON-DEPLOYED:</u><br>1630249 LBS<br><br><u>CARGO TOTAL:</u><br>4365726 LBS<br><br><u>PERFORMANCE MARGINS (LBS):</u><br>FPR: 2821<br>FUEL BIAS: 954<br>FINAL TDDP: 1968<br>RECON: 3211<br><br><u>PAYLOADS:</u><br><u>PLB:</u> ISS-UL F6 (AMS-02 ELC 3)<br>MISSE 7 Return ,<br>MISSE 8, STORM<br>DTO-703<br><br><u>MIDDECK:</u><br>ISS-UL65, MAUI, SEITE, SIMPLEX, RAMBO-2 | <i><b>Brief Mission Summary:</b> The STS-134 (36th mission to ISS) delivered the \$2 billion Alpha Magnetic Spectrometer-2 (AMS-02) to the ISS. AMS-02 is a particle physics detector designed to search for dark matter and for antimatter (first discovered by British physicist Paul Dirac in 1920's) in the universe. MIT Prof. Sam Ting is the AMS Principal Investigator. ISS spare parts and a suite of DoD Experiments were also delivered to orbit. Four EVA's were conducted for ISS maintenance and the Orbiter OBSS was transferred to ISS as a permanent fixture. This was the final flight of Endeavour (25 flights).</i><br><br><u>KSC W/D</u><br>OPF: 263 days+ 89 Non-work days + 17 holidays + 2 safety days<br>VAB: 9 +1C (Contingency) day + 1Wx<br>PAD A: 53+14C<br>Total Work Days = 325 (OPF processing occurred over a total time period of 371 days)<br><br><u>POSTPONEMENTS:</u><br>- Baselined STS-134 to FDRD - launch date of 07/29/10 on 06/30/09.<br>- Ppd. to 11/26/10 on 07/01/10. Delayed to late November after a decision to replace the magnet at the heart of the Alpha Magnetic Spectrometer payload.<br>- Ppd. to 02/26/11 on 07/01/10. A late-November/early December launch was ruled out because of conflicts with other planned station launches. Temperature constraints related to the station's orbit prevented a launch in January and range conflicts with other unmanned missions pushed the approved launch date to Feb. 26.<br>- Ppd. to NET 04/01/11 on 12/03/10 due to STS-133 slip for ET stringer problems.<br>- Ppd. to 04/19/11 on 01/26/11. This date was driven by the launch pad turnaround time required after STS-133 launch.<br>- Ppd. to 04/29/11 on 04/04/11 due to conflicts with Russian Progress vehicle flight to ISS.<br><br><u>LAUNCH SCRUBS:</u> - Launch scrubbed on 04/29/11 due to failed APU fuel line heater. Launch rescheduled for NET 05/02/11. On 05/02/11 launch was initially rescheduled to NET 05/08/11, then later to 05/10/11 to allow time to R&R faulty Load Control Assembly (LCA) box. On 05/06/11 managers announced earliest launch date was now 05/16/11 pending resolution of additional electrical testing. Mike Moses at 05/09/11 Press Brief: "Our confidence to fly is we've done functional on all the components and know we have good power to those heaters and they're performing just fine. ... we have confidence in launching Monday the 16 <sup>th</sup> at 8:56 am EDT". Technical scrub. |  |   |
| <div></div> |  |  |   |  |  |   |  |   |   |  |   |
|   |  |  |   | STS-134 - (16 May 2011)  |  |   |   |   |   |  |   |
|   |  |  |   | ENDEAVOUR'S FINAL LIFT-OFF   |  |   | Continued...   |   |   |  |   |
|   |  |  |   |  |  |   | Continued...   |   |   |  |   |

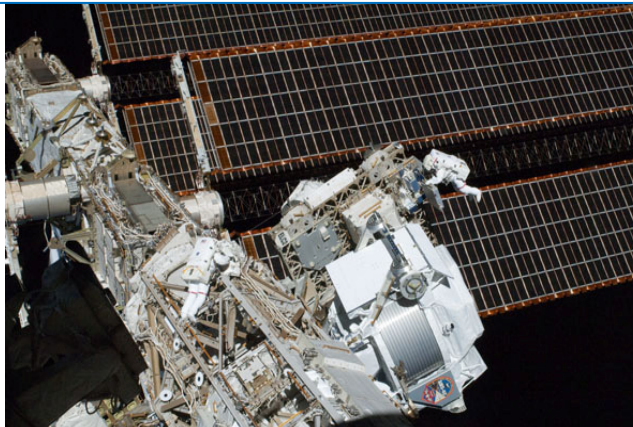



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-241 - STS-134

| FLT NO.  | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br>LANDING TIMES<br>FLT DURATION, WINDS  | SSME-TL<br>NOM-ABORT<br>EMERG<br>THROTTLE<br>PROFILE<br>ENG. S.N.                  | SRB<br>RSRM<br>AND<br>ET  | ORBIT<br>INC<br>HA/HP |   | FSW   | PAYLOAD<br>WEIGHTS,<br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--|---------|---|--|---|--|---|-----------------------|---|---|--|--|
| STS-134/ULF6<br><br>Continued...   | OV-105  | Continued...<br><br>SS EVA 162<br>DOCKED QUEST EVA 80<br>EMU/TETHERED EVA 155<br>SCHEDULED EVA 153<br>DURATION 7:24:15<br><br><u>CAPCOMS:</u><br><u>SHUTTLE</u><br>Ascent - Barry Wilmore<br>- Lee Archambault/Wx<br>LD/O1 - Megan McArthur<br>O2 - Steve Robinson<br>Planning:<br>- Shannon Lucid<br>Entry - Barry Wilmore<br>- Terry Virts/Wx<br>Team 4 - N/A<br><u>ISS</u><br>O1 - Rob hayhurst<br>LD/O2 - Lucia McCullough<br>O3 - Dan Tani | Continued...<br><br><u>SE TAL (ZZA 104):</u><br>6:00(P) 5:56(A)<br><br><u>PTM (U/S 181 FPS):</u><br>6:01(P) 5:56(A)<br><br><u>SE PRESS 104</u><br>6:54(P) 6:55 (A)<br><br><u>MECO CMD:</u><br>8:21.8 (P) 8:21.5 (A)<br><u>VI:</u><br>25819(P) 25818(A)<br><br><u>OMS-2:</u><br>37:00 (P) 36:57(A)<br>260(P) 259(A) FPS | Continued...<br><br><u>DRAG CHUTE</u><br><u>DEPLOY:</u> 184 KEAS<br>152:06:34:53Z<br><br><u>NLGTD:</u> 6034 FT<br>152:06:34:54Z<br><u>VEL:</u> 154 KGS<br>149 KEAS<br><u>HDOT:</u> - 4.5 FPS<br><br><u>BRK INIT:</u> 119 KGS<br><br><u>DRAG CHUTE</u><br><u>JETTISON:</u><br>152:06:35:19Z<br>47 KGS<br><br><u>BRK DECEL FPS<sup>2</sup>:</u><br>AVE 8.3 PK 11.7<br><br><u>WHEELS STOP:</u><br>152:06:35:32Z<br>9712 FT |  |   | Continued...          |   | 5 CRYO TANK<br>SETS, ODS,<br>SRMS (90)<br>OBSS Remains<br>on ISS, SSPTS | Continued...<br><br><u>LAUNCH WINDOW:</u><br>Window open at 136:12:55:43Z and close at 136:13:01:29Z<br>Preferred Launch Time was 136:12:56:28 (In-Plane Time) for a launch window of 5M01S (preferred).<br><br><u>LAUNCH DELAYS:</u> None.<br><br><u>TAL WEATHER:</u> Spaceflight Meteorology Group (SMG) reported at least one site would have favorable weather. High pressure gave mostly clear skies at ZZA & FMI, but head winds near limit at FMI. Moron reported concerns for thunderstorms. ZZA was selected as prime TAL site for launch. The slight chance of thunderstorms at MRN was removed one hour before launch giving Mission Control Team two acceptable TAL sites with FMI marginally acceptable.<br><br><u>PERFORMANCE ENHANCEMENTS</u><br>Include the standard set plus: 1) PE Operational High Q - TRN/APR, 2) OMS Assist, 3) a 52 nautical mile MECO, & 4) Del Psi<br><br><u>FLIGHT DURATION CHANGES:</u> None.<br><br><u>FIRSTS/LASTS/MOSTS:</u><br>- Last flight of Endeavour.<br>- First flight controlled from JSC MCC renamed for Dr. Christopher C. Kraft, Jr. on April 14, 2011.<br>- First Papal call to space. On Saturday, May 21, 2011 Pope Benedict XVI commended crews for their courage and blessed them with prayers.<br>- First undock of Soyuz while Shuttle is docked to ISS. Leagcy photo by Soyuz of ISS with Docked Shuttle.<br>- Last EVA's of Shuttle crew. Feustel, Chamitoff, & Fincke rotated through 4 EVA's. "We will be traversing from one end of the station to the other," said Feustel.<br>- Most time in space by an American: Mike Fincke surpassed Peggy Whitson's record of 377cumulative days finishing with 382 days.<br><br><u>NIGHT LAUNCH:</u> N/A<br><br><u>NIGHT LANDING KSC #18:</u> (#24 in Shuttle history)<br><br><u>RENDEZVOUS: #80</u> Rendezvous and dock with ISS.<br><br>Continued... |  |
|       |         |   |  | <u>ROLLOUT:</u><br>6574 FT 0:42 M:S<br><br><u>WINDS:</u><br>-2 H KTS 0 KTS<br><u>OFFICIAL:</u><br>32002P03KT(X1P1 T2P3)<br><br><u>DENS ALT:</u> 844 FT<br><br><u>FLT DURATION:</u><br>15:17:38:22<br><br><u>S/I:</u><br>1305:21:45:26<br><br><u>OV-105:</u><br>296:03:17:45<br><br>Continued...   |  | ABOVE: Jsc2011e036650 --STS-134 was first flight controlled from JSC Mission Control Center after it was renamed in honor of Christopher C. Kraft, Jr. on April 14, 2011.<br>BELOW: Jsc2011e036646 -- Chris speaks at the ceremony. He was NASA's 1st Flight Director for manned spaceflight. He served on all Mercury & several Gemini flights, was one of the designers & implementers of the MCC, and was JSC Center Director from 1972 to 1982. Call Name - <b>Red Flight</b> . |                       |  |   |  |  |
| S134-E- 7189 - AMS In the grasp of the Orbiter's robotic Canadarm for transfer to ISS. |         | MIT Professor Sam Ting the Principal Investigator for the \$2 Billion AMS-02 in search of cosmic dark matter & antimatter. (AMS-01 was flown & tested on STS-91.)   |  |   |  |   |                       |   |   |  |  |



# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.      | ORBITER | CREW (7)<br><br>TITLE, NAMES & EVA'S  | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES  | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N. | SRB RSRM<br><br>AND ET  | ORBIT<br><br>INC HA/HP  |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--------------|---------|---|--|--|--|---|---|--|-----|---|---|
| STS-134/ULF6 |         | <div>Crew "Star Trek" Connection</div> <div></div> |  | Continued...<br><u>DISTANCE:</u><br>6,510,221 sm<br><br><u>TOTAL OV-105 DISTANCE</u><br>122,883,151 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>536,308,104 sm | S134-E-009265 -- EVA-1 Feustel (rt) & Chamitoff (lt)         |   | <div></div> |  |     | Continued...<br><b>VIP</b><br>CDR Mark Kelly's wife & U.S. Representative Gabrielle Giffords severely wounded in a shooting at a public event in Tucson, Arizona on Jan. 8, 2011, was able to attend the launch.<br><br><b>EVE NTS:</b><br>- FD1: OMS2 ignition at 136:13:33:25Z resulted in a 175.9 by 124.7 NM orbit.<br>- FD2: RCC surveys showed some areas of concern. Focus Inspection required on FD6<br>- T1 maneuver at 138:07:38:13Z resulted in a 186.1 by182.8 NM orbit.<br>- FD3: Performed R-Bar Pitch Maneuver.<br>- Docking Contact occurred at 138:10:13:52Z<br>- Hard Dock, hooks closed, occurred at 138:10:25:15Z<br>- ISS Hatch opened at 6:38 AM CDT May 18, 2011.<br>- FD4: AMS handed off from Shuttle arm to ISS arm and installed on ISS. Scientists immediately began detecting "thousands and thousands" of subatomic particles from deep space.<br>FD5: - DAT team cleared ascent RCC damage, but recommended a Focused Inspection of area between MLGD & ET door. MMT approved for FD6.<br>- FD5: EVA 1: Feustel & Chamitoff completed Installation & retrieval of MISSE experiments, & installations of: S3 CETA light, SARJ cover 7, P3/P4 ammonia jumper on ISS. Chamitoff's ppCO2 sensor dropped out during EWC antenna task. Flight rule required termination of the EVA. EVA1 duration 6:19<br>- FD6: Focused Inspection was completed. DATteam analysis using these images cleared TPS for safe entry.<br>- FD7: EVA 2: Feustel & Fincke completed all tasks, however, duration was 1:30 longer than planned due to H/W issues. During port SARJ lube task some loose bolts prevented removal of 2 covers & reinstallation of another. Also, after filling P6 truss PVTCS one ammonia flake was seen near Fincke's suit. Inspections revealed no visible contamination. Other tasks included SPDM LEE lube & S1 Radiator Stowage Beam installation. EVA2 duration 8:07.<br>- FD8: GMT 143:21:35 Soyuz TMA-20 undocking from ISS & imagery operations of Shuttle docked to ISS.<br>- FD10: EVA3: Feustel & Fincke completed all tasks for servicing of ISS, installing cables for the power system & completion of work on a wireless communications system. EVA3 duration 6:54.<br>- FD10 the OBSS will be left behind to serve as an extension for station use if needed in the future. |   |
|              |         | S134-E-009631-- EVA 4 Fincke (Below)  | <div></div> <div>Last Shuttle Crew EVA May 25, 2011</div> |  |  | <div></div>  |   |  |     |   |   |
|              |         | S134-E-009647 -- EVA 4 Chamitoff (Above)  | <div></div>  |  |  | ISS027-E-035698 --- Crews STS-134 (in Black) & EXP 27 (in Blue) pose in ISS Kibo: It to rt (front row) are Paolo Nespoli/ESA, CDR Dmitry Kondratyev/RSA, CDR Kelly & Vittori/ESA; and (back row), Cady Coleman, Andrey Borisenko/RSA, Alexander Samokutyaev/RSA, Ron Garan, Fincke, Feustel/ESA, Chamitoff & PLT Johnson. |   |  |     | Continued...  |   |



# SPACE SHUTTLE MISSIONS SUMMARY

Page 2-243 - STS-134

STS-134/ULF6



**FD 7: JSC2011-E-046603 (21 May 2011)** --- This overall view of the space shuttle FCR in the Christopher C. Kraft, Jr. Mission Control Center was taken during a special call from Pope Benedict XVI (upper left) in the Vatican to the STS-134 and Expedition 27 crews (center screen) on the ISS.



JSC2011-E-050144 --- CAPCOMs Terry Virts (left) and Barry Wilmore on console in CCK-MCC.

MISSION HIGHLIGHTS  
(LAUNCH SCRUBS/DELAYS,  
TAL WEATHER, ASCENT I-LOADS,  
FIRSTS, SIGNIFICANT ANOMALIES, ETC.)

Continued...

## EVENTS: Continued

- FD12: EVA 4: Fincke & Chamitoff completed all major objectives including: OBSS Stow on ISS, P6 PGDF Retrieve, & OBSS EFGF/PDGR Swap. Only items not completed: relocation of APFR from P6 and stowing EFGF on Tool Stowage Assembly (TSA) in Shuttle P/L Bay. EVA4 duration 7:24:15. **This was last EVA of the Shuttle era.**
- FD14: ISS reboost with 14-min Orbiter RCS Verniers completed for 1.8 fps burn.
- Transfers:
  - 29,370 pounds of H/W to ISS
  - 17 Pounds of Oxygen to ISS (Quest tanks)
  - 278 Pounds of Oxygen to ISS (stack repress)
  - 18 Pounds of Nitrogen to ISS
  - 2,266 Pounds of middeck items to ISS
  - 2,235 Pounds of middeck returned to Endeavour
- ISS Mass in space 904,991 Pounds
- FD15: Undock from ISS complete at 150:03:55:12Z
- FD15: Completed DTO for new docking system - Sensor Test for Orion Relative Navigation Risk Mitigation (STORM) - "Went exceptionally well." Anthony Ceccacci/FD.
- FD16: No significant comm outage during blackout timeframe. Start of RF Blackout : MET 15/17:09, good comm on TDRS-174 & Orbiter upper antennas. 1st Roll Maneuver: MET 15/17:11, still on upper antenna & good comm. 1st Roll Reversal: MET 15/17:20, INCO handoff to TDRS-46, still on uppers & good comm. Hand down to MILA: MET 15/17:25.

## SIGNIFICANT ANOMALIES:

### Orbiter:

- RH NLG P2 Pressure Measurement(V51P0373A) Erratic/Off Scale High During Ascent
- DURING PRE-LAUNCH OPERATIONS ON APRIL 29, AUXILIARY POWER UNIT (APU) 1 FUEL TEST LINE AND FUEL SERVICE LINE B HEATERS FAILED TO ACTIVATE (TEMPERATURE TRENDED BELOW THE LCC LIMIT OF 45 DEG F IN LCC APU-14) WITH BOTH GROUND COMMAND AND PANEL SWITCH ACTIVATION.

### SRB:

- RH SRB MAIN CHUTE FAILURE ? GORE 26 FAILED FROM THE SKIRT BAND THROUGH THE VENT BAND.

KSC, RSRM, SSME, MOD. & ET - None.

### Integration:

- Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)
- Cylindrical Debris Observed Near +Y Thrust Panel During SRB Separation



**FD 11: May 25, 2011 the 50th Anniversary of President John F. Kennedy's historic space message to a joint session of Congress, on May 25, 1961.**

***"...I believe this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth."***

**And ending with... "We have a long way to go in this space race. But this is the new ocean, and I believe that the United States must sail on it and be in a position second to none."**

**America has sailed this ocean for the past 50 years, and grabbed the lead on July 20, 1969. The question now is: will she still be the lead ship on this ocean for the next 50 years?**



## ----- SALUTE TO ENDEAVOUR AND ITS FLIGHT CREW -----

STS-134/ULF7



FD 8: iss027e036679 (May 23, 2011) ---- One of first legacy photos taken from Soyuz TMA-20 of a Shuttle (Endeavour, left of center) docked to ISS.



ABOVE: STS134-070 (1 June 2011) --- After 19 years of service, xenon lights illuminate Endeavour's drag chute during it's last landing & Shuttle's last night landing.

BELOW: 201106010004hq (1 June 2011) --- Crew poses in front of Endeavour post- landing: (Lt to Rt) Vittori, Johnson, CDR Kelly, Fincke, Chamitoff, & Feustel.



## STS-134/ULF7 ----- SALUTE TO ENDEAVOUR AND SOME OF ITS OPERATIONS SUPPORT TEAM -----



**TOP: JSC2011-E-048881 --- STS-134 Orbit 3 FCT. FD Kwatsi Alibaruho (left) on the front row.**

**BOTTOM: JSC2011-E-048941 --- Entry FCT. FD Tony Ceccacci (third from left) on the front row with CAPCOM Barry Wilmore holding STS-134 mission logo.**

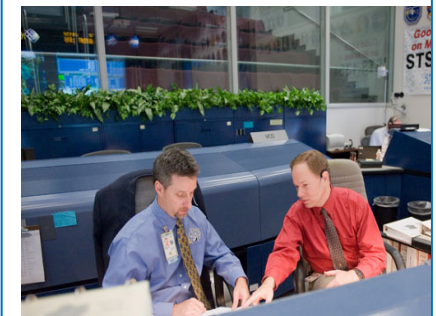


**Shuttle Legacy Mural - Hanging in LCC Firing Room at KSC**



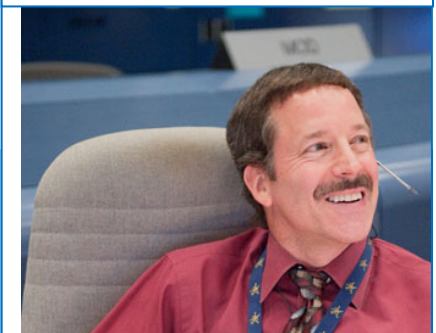
**ENDEAVOUR: From Mike Leinbach/Launch Director/KSC**

KSC-2010-4454 (<http://mediaarchive.ksc.nasa.gov/index.cfm>). This Tribute Display features Endeavour soaring into orbit above the sailing vessel HMS Endeavour for which the orbiter was named. The Cupola, delivered to the International Space Station by Endeavour on STS-130, is shown framing various images of Endeavour. The images represent the phases of mission processing and execution for the Space Shuttle Program. The first ever use of a drag chute during orbiter landing (STS-49) is depicted in the top window and moving clockwise the images symbolize the following: Rollout to the Pad, Ferry Flight return to Kennedy Space Center, Orbiter Processing Facility Roll-in, Docking at the International Space Station, and Lifting Operations for Orbiter Mate in the Vehicle Assembly Building. The background image was captured by the Hubble Space Telescope and signifies the first servicing mission which was performed by the Endeavour crew on STS-61. Crew-designed patches from Endeavour's maiden voyage through her final mission are shown ascending toward the stars.



**FD LD/O1 Gary Horlacher (left) & Chief FD John McCullough**

**FD O4 Rick LaBrode**



**Kelly Humphries/PAO**





**ATLANTIS COMING HOME TO KSC**



*An unprecedented view, as seen by the ISS Exp 28 crew, of Space Shuttle Atlantis on its way home with its plasma trail generated during the heat of entry. Airglow over Earth and stars can be seen in the background.*

*(ISS028-E-018214)*




# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.      |  | ORBITER   | CREW (4)<br><br>TITLE, NAMES & EVA'S   | LAUNCH SITE, LIFTOFF TIME, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE<br><br>LANDING TIMES<br>FLT DURATION, WINDS   | SSME-TL NOM-ABORT EMERG<br><br>THROTTLE PROFILE<br>ENG. S.N.  | SRB RSRM<br><br>AND ET  | ORBIT   |              | FSW   | PAYLOAD WEIGHTS,<br><br>PAYLOADS/<br>EXPERIMENTS  | MISSION HIGHLIGHTS<br>(LAUNCH SCRUBS/DELAYS,<br><br>TAL WEATHER, ASCENT I-LOADS,<br>FIRSTS, SIGNIFICANT ANOMALIES, ETC.) |
|--------------|--|---|--|--|--|---|---|---|--------------|---|---|--|
| STS-135/ULF7 |  | OV-104<br>(Flight 33)<br>ATLANTIS<br>LAST FLIGHT OF SHUTTLE PROGRAM | CDR:<br>Chris Ferguson<br>(Flt 3 - STS-115, STS-126)<br>P847/R300/V197/M179<br><br>PLT<br>Doug Hurley<br>(Flt 2 - STS-127)<br>P848/R358/V227/M295<br><br>MS 1<br>Sandy Magnus<br>Flt3- STS-112,<br>(UP ON STS-126, stay ISS,<br>DN on STS-119)<br>P849/R284/V200/F36<br><br>MS 2<br>Rex Walheim<br>(Flt3 - STS-110, STS-122)<br>P850/R277/V193/M243<br><br>SS EVA's<br>No SS EVAs were scheduled for this flight. (There was an ISS Crew EVA by Michael Fossum & Ronald Garan during this mission for a duration of 6:31 hr:min) | KSC 39A<br>189:15:29:04Z<br>11:26:46 EDT (P)<br>11:29:04 EDT (A)<br>Friday (29)<br>07/08/11 (16)<br><br>LAUNCH WINDOW:<br>9M6S (Total)<br>4M33S (Preferred)<br><br>EOM PLS: KSC<br>TAL: ZZA30L<br>TAL WX: MRN ,<br>FMI<br><br>SELECTED:<br>RTLS: KSC15 N/N<br>TAL: ZZA30L N/N<br>AOA: NOR17 N/N<br>1 <sup>ST</sup> DAY PLS:<br>EDW22 N/N<br><br>TDEL:<br>0.000 (P) 0.082 (A)<br><br>MAX Q NAV:<br>745 (P) 734 (A)<br><br>SRB STG:<br>2:02.8 (P) 2:03.0 (A)<br><br>PERF: NOMINAL<br><br>2 ENG TAL (MRN):<br>2:32 (P) 2:37 (A)<br><br>NEG RET (2@ 104):<br>3:54(P) 3:55(A)<br><br>PTA (U/S 157 FPS):<br>5:02(P) 5:07(A)<br><br>SE TAL (ZZA 104):<br>6:02 (P) 5:59(A)<br><br>Continued... | KSC15 KSC (78)<br>202: 09:56:58Z<br>4:56:58 AM CDT<br>Thursday (12)<br>07/21/11 (13)<br><br>DEORBIT BURN:<br>202:08:49:04Z<br><br>X RANGE:385.1 NM<br><br>ORBIT DIR: A/L (47)<br>AIM PT: Nominal<br><br>Continued... | 104/104/<br>109%<br><br>PREDICTED:<br>100/104.5/104.5/<br>72/104.5<br><br>ACTUAL:<br>100/104.5/72/<br>104.5<br><br>1 = 2047 (15)<br>2 = 2060 (3)<br>3 = 2045 (12) | BI-146<br>RSRM<br>114<br><br>ET-138<br>SLWT 43<br>w/Stringer<br>Mod<br><br>ET<br>IMPACT<br>1:13:58<br>MET<br>LAT:<br>36.871S<br>LONG:<br>159.695W | 51.6<br>(37)<br><br>DIRECT<br>INSERTION<br><br>POST OMS-2<br>124.3x84.9 NM<br><br>DEORBIT<br>HA 209.8 NM<br>HP 25.3 NM<br><br>ENTRY<br>VELOCITY:<br>25902 FPS<br><br>ENTRY<br>RANGE:<br>4407 NM | OI-34<br>(7) | CARGO:<br>37534 LBS<br><br>PAYLOAD<br>CHARGEABLE:<br>30425 LBS<br><br>DEPLOYED:<br>27997 LBS<br><br>NON-DEPLOYED:<br>2137 LBS<br><br>MIDDECK:<br>291 LBS<br><br>SHUTTLE<br>ACCUMULATED<br>WEIGHTS:<br>DEPLOYED:<br>1787958 LBS<br><br>NON-DEPLOYED:<br>1632677 LBS<br><br>CARGO TOTAL:<br>4403260 LBS<br><br>PERFORMANCE<br>MARGINS (LBS):<br>FPR: 2821<br>FUEL BIAS: 954<br>FINAL TDDP: 1987<br>RECON: N/A<br><br>PAYLOADS:<br>PLB: ISS-UL F7<br>(MPLM, LMC),<br>TRIDAR AR&D<br>SENSOR, DTO-<br>701A,PSSC<br><br>MIDDECK:<br>MAUI, SEITE,<br>SIMPLEX,<br>RAMBO-2<br><br>5 CRYO TANK<br>SETS, ODS,<br>SRMS (91)<br>OBSS , SSPTS,<br>APCUs, ROEU | <b>Brief Mission Summary:</b> With U.S. Congress approval NASA flies one more flight. STS-135 "The Final Mission" (37th mission to ISS) delivered supplies and logistics to ISS via the Raffaello Multi-Purpose Logistics Module and the middeck cargo area. Purpose of these supplies and spare parts was to provide "sustenance of the [ISS] and its crew in the post-shuttle era" [excerpt from PAO press Kit]. The mission also flew the Robotic Refueling Mission (RFM) an experiment to demonstrate robotically refueling of satellites. This final flight of Atlantis and of the 30-year Space Shuttle Flight Program was witnessed by an estimated crowd of one million people.<br><br>KSC W/D<br>OPF: 242 days +96 Non-work days +17 H (holiday)<br>VAB-1: 9 + 4C (Contingency) days +1H<br>PAD A: 35+2C+1H<br>Total Work Days = 286 (OPF processing occurred over a total time period of 355 days)<br><br>POSTPONEMENTS:<br>- Baselined STS-135 to FDRD - Revised STS-335 rescue mission to STS-135 on 01/31/11 with launch date of 06/28/11.<br>- Ppd. to 07/08/11 on 05/24/11 due to STS-134 slip.<br><br>LAUNCH SCRUBS: None.<br><br>LAUNCH WINDOW:<br>Window open at 189:15:22:13Z and close at 189:15:31:19Z<br>Preferred Launch Time was 189:15:26:46Z (In-Plane Time) for a launch window of 4M33S (preferred).<br><br>LAUNCH DELAYS: Held at T-31 seconds for 2M 18S to confirm GOX vent arm retracted. Note: Holding @T-31 sec was "inside of drain back" which further limited the available window to 3M16S. Launch occurred with 58 Sec remaining in that launch window.<br><br>TAL WEATHER: Spaceflight Meteorology Group (SMG) reported weather at TAL sites was "Solid GO" with clear skies & light winds at Moron, Spain and only a few low clouds & winds within flight rules at Zaragoza, Spain & Istres France. RTLS weather was NO GO through out the countdown due to showers within 20nm of SLF. Mark McDonald, Flight Dynamics Officer (FDO), was asked & concluded there would be enough energy to fly through a rain shower upon re-entry. The FD, Richard Jones, waived the RTLS weather flight rule and proceeded with launch countdown.<br><br>PERFORMANCE ENHANCEMENTS<br>Include the standard set plus: 1) PE Operational High Q - SUM/JUL, 2) OMS Assist, 3) a 52 NM MECO, & 4) Del Psi.<br><br>Continued... |  |



The "Katrina Tank" recovered from Hurricane Katrina and is ready to fly. (Courtesy Lockheed Martin – Michoud)



FINAL LIFT-OFF at 11:29 a.m. (EDT)  
on July 8, 2011 (STS-135 -S-103)



The "Katrina Tank" recovered from Hurricane Katrina and is ready to fly. (Courtesy Lockheed Martin – Michoud)



FINAL LIFT-OFF at 11:29 a.m. (EDT)  
on July 8, 2011 (STS-135 -S-103)









# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.  |  | ORBITER | CREW (7)   | LAUNCH SITE, LIFTOFF TIME,                            | LANDING SITE/ RUNWAY, CROSSRANGE         | MSME-TL NOM-ABORT EMERG  | SRB RSRM  | ORBIT |       | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |              |
|--|--|---------|--|---|--|--|---|-------|-------|-----|--|---|--------------|
|  |  |         | TITLE, NAMES & EVA'S   | LANDING SITES, ABORT TIMES                            | LANDING TIMES FLT DURATION, WINDS        | THROTTLE PROFILE ENG. S.N.   | AND ET  | INC   | HA/HP |     |  |   |              |
| STS-135/ULF7   |  | OV-104  | Continued...   | Continued...  | Continued...                             | Continued...   | BELOW: S135-E-008061 --- In what has become a tradition for Shuttle & ISS crews, STS-135 & ISS Exp 28 crews formed a microgravity circle for a portrait aboard JAXA Kibo Laboratory. STS-135 crew consists of NASA astronauts Chris Ferguson, Doug Hurley, Sandy Magnus and Rex Walheim; Exp 28 crewmembers are JAXA astronaut Satoshi Furukawa, NASA astronauts Ron Garan and Mike Fossum, and Russian cosmonauts Andrey Borisenko, Alexander Samokutyaev and Sergei Volkov. Shuttle & ISS CDRs Ferguson and Borisenko are in the 12 o'clock & six o'clock positions, respectively, on the circle. The U.S. flag pictured was flown on the first Space Shuttle mission, STS-1, and flew on this mission to be presented to the ISS crew. It will remain on board until the next crew launched [commercially] from the U.S. will retrieve it for return to Earth. It will fly from Earth again, with the crew that launches from the U.S. on a journey of exploration beyond Earth orbit. |       |       |     |  |   | Continued... |
| Continued...   |  |         | MCC WHITE FLIGHT FCR (64)  | PTM (U/S 180 FPS): 6:14(P) 6:23(A)                    | MLGTD: 1649 FT 202:09:56:58Z             | M 3 EOM: WEIGHT: 226333 LBS Xcg: 1090.7 IN LANDING: WEIGHT: 226270 LBS Xcg:1092.4 IN |   |       |       |     |  |   |              |
| CAPCOMS: SHUTTLE   |  |         | Ascent - Richard Jones LD/O1 - Kwastsi Alibaruho O2- Rick LaBrode Planning - Paul Dye Entry - Tony Ceccacci MOD – John Mccullough Team 4 - N/A | SE PRESS 104 6:52(P) 6:55 (A)                         | VEL: 221 KGS 216 KEAS HDOT: -2.1 FPS     |  |   |       |       |     |  | <u>FIRSTS/LASTS/MOSTS:</u>  |              |
| Ascent - Barry Wilmore - Lee Archambault/Wx LD/O1 - Steve Robinson O2 - Megan McArthur Planning: - Shannon Lucid Entry - Barry Wilmore - Charlie Hobaugh/Wx Team 4 - N/A |  |         | ISS  | MECO CMD: 8:23.5 (P) 8:23.8 (A) VI: 25819(P) 25817(A) | TD NORM 205: 2809 FT                     |  |   |       |       |     |  | - Last flight of Atlantis & Space Shuttle Program.  |              |
| ISS  |  |         | O1 - Jerry Jason LD/O2 - Chris Edelen O3 - Courtenay Team 4 - N/A  | OMS-2: 37:46 (P) 37:45(A) 98.7(P) 96.8(A) FPS         | DRAG CHUTE DEPLOY:192 KEAS 202:09:57:03Z |  |   |       |       |     |  | - Sandra Magnus is "Last Woman to Blast Off" in Space Shuttle.  |              |
| O1 - Dan Tani LD/O2 - Rob Hayhurst O3 - Kathy Bolt Team 4 - N/A  |  |         |  |   | BRK INIT: 118 KGS                        |  |   |       |       |     |  | - First iPhone launched into space to run an experimental app designed by Odyssey Space Research.   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | <u>NIGHT LAUNCH:</u> N/A  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | <u>NIGHT LANDING KSC #19:</u> (#25 in Shuttle history)  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | <u>RENDEZVOUS: #81</u> Rendezvous and dock with ISS.  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | <u>EVE NTS:</u>   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD1: OMS2 ignition at 189:16:06:49Z resulted in a 124.3 by 84.9 NM orbit.   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD2 Wakeup: "Viva la Vida" by Coldplay for Doug Hurley (w/greeting from MSFC employees)   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - RCC survey data collected for DAT. Go to MMT on FD4.  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - T1 maneuver at 191:12:29:04Z resulted in a 210.5 by 207.3 nm orbit.   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD3: Performed R-Bar Pitch Maneuver.  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - Docking Contact occurred at 191:15:07:15Z   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - Hard Dock, hooks closed, occurred at 191:15:19:32Z  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - ISS Hatch opened at 11:47 AM CDT July 10, 2011.   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD4: MMT agreed to add 1 day to mission. "Additional mission content would benefit ISS transfer and utilization."   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - MPLM installed on ISS   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD5: MMT concurred with DAT assessment that Orbiter TPS was cleared for deorbit, entry, & landing.  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - ISS crewmembers Mike Fossum & Ron Garan conducted EVA completing the following activities: Readied Pump Module in P/L Bay for return, RRM installed on SPDME EOTP, MISSE 8 ORMATE installed, FGB PDGF exposed grounding wire corrected, & PMA3 cover installed. PET duration 6 hrs 31 minutes |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD7: GPC 4 (SMGPC) failed - most likely cause was a transient single event upset (radiation hit). Same event occurred on STS-71 (same vehicle & same GPC).  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD 8: GPC 2 was reconfigured as SM GPC.   |              |
|  |  |         |  |   |  |  |   |       |       |     |  | - FD 10: GPC 4 reconfigured to SM and treated as fully functional for Entry.  |              |
|  |  |         |  |   |  |  |   |       |       |     |  | Continued...  |              |

ISS028-E-015565 Atlantis as seen from ISS brings supplies & spare parts to ISS packed in MPLM at rear of P/L Bay. Last flight of the "Banana Truck"! [Atlantis was happily called the "Banana Truck" on STS-71 by Cosmonaut Strehalov, see page 2-84.]

# SPACE SHUTTLE MISSIONS SUMMARY

| FLT NO.   | ORBITER | CREW (7)             | LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES   | LANDING SITE/ RUNWAY, CROSSRANGE  | SSME-TL NOM-ABORT EMERG  | SRB RSRM | ORBIT  |  | FSW | PAYLOAD WEIGHTS, PAYLOADS/ EXPERIMENTS  | MISSION HIGHLIGHTS (LAUNCH SCRUBS/DELAYS, TAL WEATHER, ASCENT I-LOADS, FIRSTS, SIGNIFICANT ANOMALIES, ETC.)   |
|---|---------|----------------------|---|-----------------------------------|--|----------|--|--|-----|---|---|
| STS-135/ ULF7   |         | TITLE, NAMES & EVA'S |   | LANDING TIMES FLT DURATION, WINDS | THROTTLE PROFILE ENG. S.N.   | AND ET   | INC  | HA/HP  |     |   |   |
|   |         |                      | Continued...<br><u>FLT DURATION:</u><br>12:18:27:56<br><br><u>S/T:</u><br>1318:16:13:22<br><br><u>OV-104:</u><br>307:12:55:07<br><br><u>DISTANCE:</u><br>5,284,862 sm<br><br><u>TOTAL OV-104 DISTANCE</u><br>125,935,769 sm<br><br><u>TOTAL SHUTTLE DISTANCE:</u><br>541,592,966 sm |                                   | ISS028-E-017042 --- Sandy Magnus/ MS enjoys view in the panoramic Cupola, an ISS addition since her last visit.                            |          |  |  |     |   | Continued...<br><br>- <b>Transfers:</b><br>30,576 lbs of h/w to ISS – MPLM, LMC, RRM & Picosat<br>28,100 lbs of h/w from ISS MPLM LMC, & PM<br>2,977 LfWt MPES Carrier (up mass)<br>1,409 LfWt MPES Carrier (down mass)<br>550 Robotic Refueling Mission P/L mass<br>8 PicoSat mass (final deploy from a Shuttle - the 180th)<br>65 lbs of Oxygen transferred to ISS (stack repress)<br>111 lbs of Nitrogen transferred to ISS (stack repress)<br>1,652 lbs of water transferred to ISS<br>1,283 lbs of Atlantis middeck items transferred to ISS<br>723 lbs of Atlantis middeck items returned from ISS<br>- ISS Mass in space 901,745 Pounds<br>- ISS assembly (pressurized volume) 100% complete<br>- FD12: Undock from ISS complete at 200:06:27:58Z<br>- FD13 did not have an LOS due to black out but if we had been on a lower antenna we estimated blackout to be GMT 202/09:28 – 202/09:41.<br><br><u><b>SIGNIFICANT ANOMALIES:</b></u><br><u>Orbiter:</u><br>- WLEIDS SENSOR UNIT 1111 DROPPED OUT OF OOM PREMATURELY<br>- WLEIDS SENSOR UNIT 1080 HAD COMMUNICATION DROP OUTS<br>- GPC 4 (SM) AR5450<br>SRB, KSC, RSRM, SSME, ET, Integration & MOD: None. |
| S135-E-006297 --- Chris Ferguson, left, and Doug Hurley are pictured at the Commander's Station and Pilot's Station, respectively.                      |         |                      |    |                                   |   |          |  |  |     | <b>A Shuttle Goodbye to ISS</b><br><br><b>S135-E-011914</b> |   |
| S135-E-007515 --- With his feet secured on a restraint on the ISS robotic arm or Canadarm2, Ron Garan/ Exp 28 Flight Engineer, carries the pump module, |         |                      | S135-E-007457: -- Rex Walheim, Mission Specialist, works on the aft flight deck of Space Shuttle Atlantis.  |                                   | S135-E-007637 --- Close-up of Mike Fossum/ Exp 28 Flight Engineer, as he participates in the July 12 six and a half hour spacewalk on ISS. |          |  |  |     |   |   |



## ----- SALUTE -----



"God Bless America" sung by the unmistakable Kate Smith signaled the start of landing prep. FD Paul Dye, CapCom Shannon Lucid (in rear center) and the rest of the team in the CCK MCC MOCR stood during the song, which was played for the crew and all those who have worked for the Space Shuttle Program. (From PAO)



Entry Flight Control Team in Shuttle FCR in CCK MCC. FD Tony Ceccacci (center front) holds STS-135 mission logo.

(JSC2011-E-067253)



**ROSES FOR CCK MCC**

Seated on INCO console with Atlantis model is a bouquet of roses sent once again by the Shelton & Murphy families of North Texas. See history of "MCC Roses" given on flight STS-119/14A (page 2-203).

(JSC2011-E-063867)



**Space Shuttle's Last Landing Path (From PAO)**

### FINAL LANDING at 5:57 a.m. (EDT) July 21, 2011



**ATLANTIS STAYS AT KSC**



**CDR Ferguson has a big smile for the thermal tiles (JSC2011-E-067990)**



## ----- SALUTE -----



JSC2011-E-067473-- In MOCR in CCK MCC Michael Lopez-Algeria (left) Director/Flight Crew Ops for ISS shakes hands with Ascent FD Richard Jones. In middle (l to r) are Paul Hill/ Director/MOD, John McCullough/Chief FD Office & Norm Knight/Dep Ch FD Office.



JSC2011-E-070840 --- STS-135 Ascent flight control team and flight crew (black shirts) in shuttle flight control room in the CCK MCC. Flight Director Richard Jones (left) and CDR Chris Ferguson, STS-135 Commander, hold the mission logo.



JSC2011-E-064806 --- STS-135 Shuttle & ISS FD's in the shuttle FCR in CCK MCC at JSC. From left (front row) are Tony Ceccacci, Courtenay McMillan, Chris Edelen, Kwatsi Alibaruho, Gary Horlacher, and Rick LaBrode. Back row are Paul Dye, Royce Renfrew, Richard Jones and Jerry Jason.



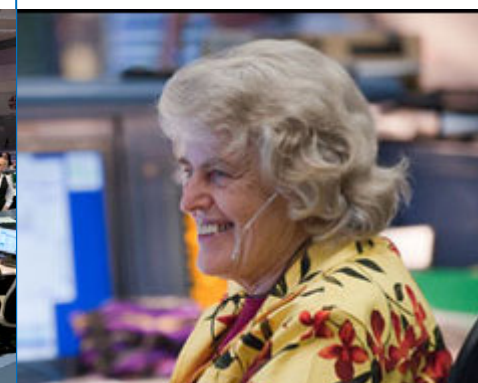
JSC2011-E-062692 --- STS-135 Orbit 1 FCT group portrait. Flight Director Kwatsi Alibaruho (center) stands on the front row.



JSC2011-E-063635 --- STS-135 Orbit 2 FCT group portrait. Flight Director Rick LaBrode holds the STS-135 mission logo.



JSC2011-E-064789 --- STS-135 Orbit 3 FCT group portrait. FD Paul Dye is in front near Shuttle model & MCC Roses.



JSC2011-E-063846 --- Shannon Lucid, STS-135 Planning Shift CAPCOM. She was one of NASA's first six women astronauts.



## ----- SALUTE -----

### On behalf of the Astronaut Office...

Now that Atlantis and the final Shuttle crew have safely returned to planet Earth, we are all feeling the finality of 30 years of Space Shuttle flights. ... While the Shuttle is an incredible, one-of-a-kind flying machine, the most important thing that this program has given us is wrapped up in all the people and expertise that turned a concept into something real. ... We are exceptionally honored to have flown with all of you as part of the Shuttle Program, and look forward to the continuation of our journey on board the International Space Station and beyond.

Peggy A. Whitson  
STS-111/Exp 5/STS-113, ISS Exp 16 CDR  
Chief, Astronaut Office



30 YEARS OF FLIGHT

### SPACE SHUTTLE PROGRAM MANAGERS

**Robert Thompson**  
February 1970 - June 1981  
**Glynn Lunney**  
June 1981 - June 1985  
**Richard Kohrs (Interim Mgr)**  
June 1985 - August 1985  
**Arnold Aldrich**  
August 1985 - November 1986  
**Richard Kohrs**  
November 1986 - June 1989  
**Leonard Nicholson**  
June 1989 - March 1993  
**Brewster Shaw**  
March 1993 - November 1995  
**Tommy Holloway**  
November 1995 - April 1999  
**Ronald Dittmore**  
April - 1999 - July 2003  
**William Parsons**  
July 2003 - September 2005  
**Wayne Hale**  
September 2005 - February 2008  
**John Shannon**  
February 2008 - To End of Shuttle Program 2011



Above:(jsc2011e071116): Lead INCO Heidi Brewer hangs final Shuttle plaque for STS-135 in White FCR in CCK MCC at JSC.

Below: Atlantis Shuttle Legacy Mural [UPDATED for STS-135] - Hanging in LCC Firing Room at KSC - From Mike Leinbach/Launch Director



STS-135 crew left this plaque in the cockpit of Atlantis as a tribute to all of the people who have worked on the Space Shuttle Program.



## ----- SALUTE -----



### A LARGE WELCOME HOME & A SUPER WELL DONE!

**ABOVE: (JSC2011-E-068785) --- A large crowd welcomes home the crew of STS-135 on July 22, 2011 at Ellington Field near JSC. AT RIGHT: (JSC2011-E-070276) --- JSC Director Michael L. Coats (left), Houston Mayor Annise Parker, U.S. Senator Kay Bailey Hutchison (R.-Texas) and STS-135 Commander Chris Ferguson enjoy the crew return ceremony. Poster reads: "HOUSTON! Always the first word in Space. Thank You!" The Mayor was also presented a flown flag by the STS-135 crew.**

### NOTES: From STS-135 (ULF7) Post Landing News Conference - July 21, 2011 (From PAO)

**Gerst** – I really want to thank the Space Shuttle team and Program for today and the entire history of the Program. I can't say enough about meeting the challenges and finishing strong. Today they met all the objectives. I'd also like to thank the nation for supporting this vehicle. It is a true marvel and allowed us to do amazing things. It's going to allow us to move forward and utilize the station and commercial cargo providers come online later this year. We need to go forward and explore.

I recognize that change is very hard, but huge improvement comes from change, so this team can accomplish great things in the future. I wish them the best. They will be successful in the future.

**Moses** – It's been a heck of a day and heck of a Program. I'm representing a team across the country today and the vehicle performed perfectly. The team here and in Houston are world class. The Marshall team put together a propulsion system that also finished strong. It's been a nice ride.

**Cabana** – It is great to have Atlantis home to stay after this mission. I can't say enough about the teams here at KSC and how they performed the last few flights. The folks that knew they were going to be out of work performed flawlessly and were dedicated to what they were doing. That is what they do. I am proud to be part of this program. We've achieved the goal of flying out the shuttle safely and we'll celebrate what we've accomplished over the last 30 years. But when that's done, we'll move on to the future.

**Leinbach** – Thanks to the KSC workforce. I've worked here all my career – 27 years. They did their job just like always. The workers here and across the country that dedicated their lives to this are my friends and I wish them well. I want to thank the press as well. You guys have been good friends of the space program as well. It was a good day. Mission complete and we're looking forward to new challenges.



## ----- SALUTE -----

Space Shuttle's "Final Four"



STS135-S-214 (21 July 2011) -- Space Shuttle's "Final Four" stand proudly in front of Atlantis after landing at KSC. From right, are CDR Chris Ferguson, PLT Doug Hurley; Sandy Magnus/MS and Rex Walheim/MS.

U.S. SENATE RESOLUTION 233 --  
HONORING THE MEN AND  
WOMEN OF THE NATIONAL  
AERONAUTICS AND SPACE  
ADMINISTRATION SPACE  
SHUTTLE PROGRAM ON  
REACHING THE HISTORIC  
MILESTONE OF THE 135TH AND  
FINAL FLIGHT OF THE SPACE  
TRANSPORTATION SYSTEM

Passed U.S. Senate on July 13, 2011



No, they are not rolling out for launch! Discovery & Endeavour are rolling to storage locations at KSC where they will remain until ready for transport to museums, see below.  
(Photo from Hering/PAO)

At Left:

**Safely Home...  
...Mission Accomplished!**

"What a privilege to be on the scene for the last Apollo splashdown AND the last Space Shuttle landing ... and, what a privilege for each of us to have been associated with such talented and dedicated people ..."

**Milt Heflin**  
Apollo Recovery Engineer- Primary  
Recovery Ship for Apollo 8, 10, 16, 17,  
Skylab 2,3,4, & ASTP  
Space Shuttle EPS, Thermal, EGIL,  
EECOM & Flight Director  
JSC Associate Director (Technical)

[That's Milt with "hands on hips".  
Yes, he was there & there. Well Done!]

**Where will they go?**

**Announced April 12, 2011:**

**OV-101 Enterprise Test Vehicle**  
- To New York City's Intrepid Museum

**OV-103 Discovery**  
- To Smithsonian National Air & Space  
Museum in Chantilly, Virginia

**OV-104 Atlantis**  
- To Kennedy Space Center, Florida

**OV-105 Endeavour**  
- To California Science Center in  
Los Angeles

**NASA officially closed the books on  
the Space Shuttle Program on August  
31, 2011.**



## APPENDIX A- SPACE SHUTTLE FLIGHT WEIGHT SUMMARY

A summary table of weight data for each shuttle element and payloads for each mission is provided in herein. The data for flights STS-1 through STS-57 was extracted from the SODB, Volume II. Effective with STS-51, the SODB data was no longer updated as flown. Therefore, the data has been obtained from the Day-of-Launch (DOL) Trajectory Design Data Package (TDDP), with Mach 3 EOM (End of Mission) and Landing Weights/CG's from the Postflight Prop 30 Reports. The Performance Margin data was extracted from the RI/Boeing Postflight Trajectory Reconstruction Reports.

Starting with STS-75, the Shuttle Program agreed to a 900-lb Ascent Performance Margin (APM) gain for all missions. STS-75 and STS-76 have 900 lbs of inert weight adjustment (-450 lbs inert weight discrepancy adjustment and -450 lbs

performance discrepancy adjustment, which were subtracted from the STS Operator Chargeable Cargo). Effective with STS-77, the -450 lbs was subtracted from the STS Operator Chargeable Cargo and the -450 lbs performance discrepancy is included in the MPS Prop Inventory. Effective with STS-79, the performance adjustment was changed to -200 lbs which is subtracted from the STS Operations Chargeable Cargo. Finally, beginning with STS-97 the TDDP included an item for "RECONSTRUCTED ASCENT PERFORMANCE COLLECTOR" in the "Shuttle Total Weight at SRB Ignition".

The P/L Deployed Weights for MIR flights reflect the weights of hardware transferred to the MIR (does not include consumables transferred to MIR). DOD mission weight data was not available for this document.



APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY  
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT               | ORBITER            |   |   |             |          |      |                                 | CARGO                        |                     |              |                                |                                 |                          |                               | ORBITER TOTALS |                       |                            | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER                          |            | ORBITER |         |        |
|----------------------|--------------------|---|---|-------------|----------|------|---------------------------------|------------------------------|---------------------|--------------|--------------------------------|---------------------------------|--------------------------|-------------------------------|----------------|-----------------------|----------------------------|--------------------------------|------------------------------------|-------------------------------------|---|----------------------------------|------------|---------|---------|--------|
|                      | TAIL<br>NO.<br>OV- | W/O<br>CONS.                              | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |      | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS       |                     |              |                                |                                 | FLIGHT<br>CARGO<br>TOTAL | ACCUMULATED                   |                | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT |                                |                                    |                                     |   | ACCUM<br>WT @<br>ORBIT<br>INSERT | AT         |         | AT      |        |
|                      |                    |   |   |             | FWD      | AFT  |                                 | PRI<br>DPLY/<br>NON-<br>DPLY | DPLY<br>AND<br>RETR | RETR<br>ONLY | ANCIL<br>OR *<br>MID-<br>DECK  | CHARGE-<br>ABLE<br>PYLD/<br>STS |                          | PYLD<br>DPLY/<br>NON-<br>DPLY | CARGO<br>TOTAL |                       |                            |                                |                                    |                                     |   |                                  | MACH 3 EOM |         | LANDING |        |
|                      |                    |   |   |             |          |      |                                 |                              |                     |              |                                |                                 |                          |                               |                |                       |                            |                                |                                    |                                     |   |                                  | WT         | X CG    | WT      | X CG   |
| STS-1                | 102<br>(1)         | 172425                                    | 5197                                    | 18408       | 2461     | 5371 | 208437                          | 0<br>10823                   | 0                   | 0            |                                |                                 | 10823                    | 0<br>10823                    | 10823          | 219260                | 208415                     | 208415                         | 1664455                            | 1295940<br>1298160                  | 4459280                                     | NOT<br>AVAILABLE                 | 195943     | 1096.7  | 195473  | 1098.1 |
| STS-2                | 102<br>(2)         | 175211                                    | 5922                                    | 18011       | 2469     | 5383 | 212161                          | 0<br>18778                   | 0                   | 0            |                                |                                 | 18778                    | 0<br>29601                    | 29601          | 230939                | 219844                     | 428259                         | 1647514                            | 1296747<br>1296784                  | 4471984                                     | 2049<br>275                      | 204356     | 1096.6  | 204263  | 1098.1 |
| STS-3                | 102<br>(3)         | 175374                                    | 6560                                    | 17919       | 2446     | 5384 | 212846                          | 0<br>22710                   | 0                   | 0            |                                |                                 | 22710                    | 0<br>52311                    | 52311          | 235556                | 222985                     | 651244                         | 1643507                            | 1296696<br>1296915                  | 4470555                                     | 5343<br>2278                     | 207349     | 1095.4  | 207073  | 1096.9 |
| STS-4                | 102<br>(4)         | 175581                                    | 6588                                    | 22155       | 2446     | 5344 | 217280                          | 0<br>9800                    | 0                   | 0            | 1844                           | 11644<br>12848                  | 24492                    | 0<br>63955                    | 76803          | 241772                | 228442                     | 879696                         | 1644745                            | 1298213<br>1299253                  | 4483983                                     | 4038<br>1195                     | 209141     | 1092.9  | 208947  | 1094.4 |
| STS-5                | 102<br>(5)         | 176729                                    | 5507                                    | 19804       | 2448     | 5379 | 215033                          | 14585<br>5167                | 0                   | 0            | 1078                           | 20830<br>12596                  | 32080                    | 14585<br>70200                | 108883         | 247113                | 231213                     | 1110869                        | 1644995                            | 1298256<br>1298714                  | 4489078                                     | 822<br>-1017                     | 202643     | 2094.8  | 202480  | 1096.3 |
| STS-6                | 099<br>(1)         | 172837                                    | 5364                                    | 19242       | 1964     | 5384 | 209957                          | 37546<br>6853                | 0                   | 0            | 2263                           | 46662<br>1794                   | 46971                    | 52131<br>79316                | 155854         | 256928                | 241325                     | 1352224                        | 1644495                            | 1295364<br>1296180                  | 4488967                                     | 4755<br>2463                     | 190627     | 1099.7  | 190330  | 1101.2 |
| STS-7                | 099<br>(2)         | 172822                                    | 5415                                    | 21015       | 2449     | 5372 | 212239                          | 14949<br>13002               | 3192                | 0            | 3942                           | 31893<br>5448                   | 37124                    | 67080<br>96260                | 192978         | 249363                | 233619                     | 1585843                        | 1644631                            | 1295695<br>1294346                  | 4484035                                     | 2940<br>2021                     | 204340     | 1089.8  | 204043  | 1091.2 |
| STS-8                | 099<br>(3)         | 172879                                    | 5363                                    | 22011       | 2456     | 4962 | 212837                          | 7445<br>13179                | 0                   | 0            | 5166                           | 25790<br>4440                   | 30076                    | 74525<br>114605               | 223054         | 242913                | 227365                     | 1813208                        | 1656386                            | 1297016<br>1297508                  | 4493822                                     | 14863<br>15735                   | 204141     | 1090.4  | 203945  | 1091.9 |
| STS-9                | 102<br>(6)         | 179369                                    | 6184                                    | 16000       | 2446     | 5384 | 214549                          | 0<br>32261                   | 0                   | 0            | MIDDECK<br>0<br>CRYO TK<br>870 | 33131<br>1708                   | 33264                    | 74525<br>147736               | 256318         | 247813                | 235793                     | 2049001                        | 1662238                            | 1298367<br>1297983                  | 4505505                                     | 841<br>-411                      | 220288     | 1085.8  | 220027  | 1087.1 |
| STS 41-B<br>(STS-11) | 099<br>(4)         | 173041                                    | 6210                                    | 24704       | 2446     | 4970 | 216537                          | 15073<br>10198               | 0                   | 0            | 2981                           | 28252<br>5598                   | 33868                    | 89598<br>160915               | 290186         | 250405                | 234108                     | 2283109                        | 1662570                            | 1295569<br>1296187                  | 4500237                                     | 12062<br>6961                    | 201529     | 1087.9  | 201239  | 1089.3 |
| STS 41-C             | 099<br>(5)         | 173207                                    | 5285                                    | 25096       | 2449     | 5012 | 216215                          | 21396<br>12394               | 0                   | 0            | 41                             | 33831<br>4446                   | 38266                    | 110994<br>173350              | 328452         | 254481                | 245167                     | 2528276                        | 1661790                            | 1295828<br>1296378                  | 4508234                                     | 995<br>-3322                     | 197170     | 1100.0  | 196976  | 1101.6 |
| STS-41-DR            | 103<br>(1)         | 173911                                    | 5748                                    | 23864       | 2446     | 4970 | 216105                          | 30086<br>10122               | 0                   | 0            | 1174                           | 41382<br>6521                   | 47516                    | 141080<br>184646              | 375968         | 263621                | 246903                     | 2775179                        | 1662823                            | 1296101<br>1298244                  | 4518538                                     | -1611<br>-1564                   | 202317     | 1090.7  | 201675  | 1091.7 |
| STS 41-G             | 099<br>(6)         | 175411                                    | 6236                                    | 25088       | 2465     | 4970 | 219326                          | 4949<br>11986                | 0                   | 0            | 657                            | 17592<br>5772                   | 23465                    | 146029<br>197289              | 399433         | 242791                | 226344                     | 3001523                        | 1662451                            | 1296571<br>1296300                  | 4495592                                     | 2194<br>3375                     | 202829     | 1083.7  | 202266  | 1084.8 |
| STS 51-A             | 103<br>(2)         | 174036                                    | 6311                                    | 25107       | 2446     | 4970 | 218016                          | 22764<br>15052               | 0                   | 2381         | 187                            | 38003<br>7717                   | 45306                    | 168793<br>212528              | 444739         | 263352                | 247014                     | 3248537                        | 1662369                            | 1299428<br>1299700                  | 4522111                                     | 281<br>1003                      | 207983     | 1081.4  | 207506  | 1082.6 |
| STS 51-C             | 103<br>(3)         | ----- DOD WEIGHT DATA NOT AVAILABLE ----- |   |             |          |      |                                 |                              |                     |              |                                |                                 |                          |                               |                |                       |                            |                                |                                    |                                     | --<br>-1457                                 |                                  | 1091.8     | 197700  | 1096.8  |        |
| STS 51-D             | 103<br>(4)         | 174756                                    | 6272                                    | 21464       | 2446     | 4970 | 214855                          | 22576<br>5092                | 0                   | 0            | 1079                           | 28747<br>7265                   | 35794                    | 191369<br>218699              | 480513         | 250679                | 239298                     | 3487835                        | 1661830                            | 1297460<br>1296665                  | 4504439                                     | 1243<br>1957                     | 198167     | 1092.7  | 198014  | 1094.3 |
| STS 51-B             | 099<br>(7)         | 174968                                    | 5397                                    | 22900       | 2446     | 4970 | 215847                          | 105<br>30341                 | 0                   | 0            | 302                            | 30748<br>1727                   | 31377                    | 191474<br>249342              | 511910         | 247254                | 230944                     | 3718779                        | 1661509                            | 1296246<br>1296969                  | 4501978                                     | 2536<br>3609                     | 213795     | 1084.1  | 213499  | 1085.4 |
| STS 51-G             | 103<br>(5)         | 174862                                    | 6272                                    | 18600       | 2446     | 4970 | 212316                          | 22832<br>14866               | 2217                | 0            | 560                            | 38258<br>6299                   | 44477                    | 214306<br>264768              | 556387         | 256823                | 243779                     | 3962558                        | 1661726                            | 1297968<br>1298704                  | 4518845                                     | 160<br>-1664                     | 204321     | 1082.1  | 204169  | 1083.7 |
| STS-51-F             | 099<br>(8)         | 175260                                    | 5397                                    | 25064       | 2446     | 4970 | 218303                          | 0<br>31257                   | 0                   | 0            | 1755                           | 33012<br>1492                   | 34400                    | 214306<br>297780              | 590787         | 252733                | 237931                     | 4200489                        | 1661338                            | 1300211<br>1300031                  | 4514313                                     | NOT<br>AVAILABLE                 | 216894     | 1079.8  | 216735  | 1081.3 |

APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY  
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT | ORBITER            |              |   |             |          |  |                                 | CARGO                  |  |  |  |  |                          |             | ORBITER TOTALS |                       |                            |                                  | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER<br>AT<br>MACH 3 EOM |                            | ORBITER<br>AT<br>LANDING |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|--------|--------------------|--------------|---|-------------|----------|--|---------------------------------|------------------------|--|--|--|--|--------------------------|-------------|----------------|-----------------------|----------------------------|----------------------------------|--------------------------------|------------------------------------|-------------------------------------|---|-----------------------------|----------------------------|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|        | TAIL<br>NO.<br>OV- | W/O<br>CONS. | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |  | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS |  |  |  |  | FLIGHT<br>CARGO<br>TOTAL | ACCUMULATED |                | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT | ACCUM<br>WT @<br>ORBIT<br>INSERT |                                |                                    |                                     |   | WT<br>@<br>SRB<br>IGN       | WT<br>@<br>ORBIT<br>INSERT | WT<br>@<br>SRB<br>IGN    | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN | WT<br>@<br>SRB<br>IGN |



APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY  
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT | ORBITER            |              |   |             |          |      |                                 | CARGO                        |                     |              |              |                                 |                                  |                    | ORBITER TOTALS     |                       |                            | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER                          |                  | ORBITER               |                            |                                  |    |      |    |      |
|--------|--------------------|--------------|---|-------------|----------|------|---------------------------------|------------------------------|---------------------|--------------|--------------|---------------------------------|----------------------------------|--------------------|--------------------|-----------------------|----------------------------|--------------------------------|------------------------------------|-------------------------------------|---|----------------------------------|------------------|-----------------------|----------------------------|----------------------------------|----|------|----|------|
|        | TAIL<br>NO.<br>OV- | W/O<br>CONS. | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |      | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS       |                     |              |              |                                 | FLIGHT<br><br>CARGO<br><br>TOTAL | ACCUMULATED        |                    | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT |                                |                                    |                                     |   | ACCUM<br>WT @<br>ORBIT<br>INSERT | AT<br>MACH 3 EOM | AT                    |                            |                                  |    |      |    |      |
|        |                    |              |   |             | FWD      | AFT  |                                 | PRI<br>DPLY/<br>NON-<br>DPLY | DPLY<br>AND<br>RETR | RETR<br>ONLY | MID-<br>DECK | CHARGE-<br>ABLE<br>PYLD/<br>STS |                                  | CARGO<br><br>TOTAL | CARGO<br><br>TOTAL |                       |                            |                                |                                    |                                     |   |                                  |                  | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT | ACCUM<br>WT @<br>ORBIT<br>INSERT | WT | X CG | WT | X CG |
|        |                    |              |   |             |          |      |                                 |                              |                     |              |              |                                 |                                  |                    |                    |                       |                            |                                |                                    |                                     |   |                                  |                  |                       |                            |                                  |    |      |    |      |
| STS-35 | 102<br>(10)        | 184580       | 7156                                    | 19339       | 2232     | 4971 | 223444                          | 0<br>25968                   | 0                   | 0            | 1792         | 27760<br>5277                   | 33037                            | 515171<br>435458   | 1075273            | 256511                | 243474                     | 7114615                        | 1664775                            | 1300088<br>1300140                  | 4521514                                     | 4131<br>3812                     | 225531           | 1079.1                | 225329                     | 1080.5                           |    |      |    |      |
| STS-37 | 104<br>(8)         | 177763       | 5379                                    | 20053       | 1835     | 4971 | 215167                          | 34442<br>1615                | 0                   | 0            | 743          | 36800<br>3761                   | 40561                            | 549613<br>437816   | 1115834            | 255758                | 240809                     | 7355424                        | 1664803                            | 1300130<br>1299254                  | 4519945                                     | 1116<br>525                      | 190266           | 1087.4                | 190098                     | 1089.2                           |    |      |    |      |
| STS-39 | 103<br>(12)        | 179611       | 6257                                    | 22553       | 2451     | 4974 | 221012                          | 827<br>16046                 | 4046<br>3955        | 0            | 494          | 21413<br>4881                   | 26294                            | 550440<br>454356   | 1142128            | 247336                | 236623                     | 7592047                        | 1664494                            | 1299733<br>1301485                  | 4513048                                     | 1054<br>2768                     | 211673           | 1080.3                | 211512                     | 1082.0                           |    |      |    |      |
| STS-40 | 102<br>(11)        | 185755       | 7111                                    | 13265       | 1919     | 4968 | 218184                          | 0<br>26237                   | 0                   | 0            | 1877         | 28114<br>5593                   | 33707                            | 550440<br>482470   | 1175835            | 251921                | 241175                     | 7833222                        | 1664845                            | 1301303<br>1301723                  | 4519792                                     | 3137<br>4212                     | 226737           | 1079.6                | 226535                     | 1080.9                           |    |      |    |      |
| STS-43 | 104<br>(9)         | 177623       | 6245                                    | 14126       | 1860     | 4972 | 209992                          | 37575<br>8146                | 0                   | 0            | 991          | 46712<br>2613                   | 49325                            | 588015<br>491607   | 1225160            | 259347                | 247964                     | 8081186                        | 1664898                            | 1299653<br>1299220                  | 4523118                                     | 2656<br>2593                     | 196353           | 1087.4                | 196088                     | 1089.7                           |    |      |    |      |
| STS-48 | 103<br>(13)        | 178149       | 5466                                    | 22643       | 2061     | 4970 | 218455                          | 14388<br>2066                | 0                   | 0            | 690          | 17144<br>4425                   | 21569                            | 602403<br>494363   | 1246729            | 240054                | 224141                     | 8305327                        | 1665078                            | 1298959<br>1298580                  | 4502671                                     | 510<br>-562                      | 192925           | 1096.0                | 192780                     | 1097.8                           |    |      |    |      |
| STS-44 | 104<br>(10)        | 177916       | 6245                                    | 16390       | 1893     | 4976 | 212586                          | 37588<br>5809                | 0                   | 0            | 1240         | 44637<br>2598                   | 47235                            | 639991<br>501415   | 1293964            | 259851                | 247087                     | 8552414                        | 1664283                            | 1298356<br>1300086                  | 4522576                                     | 565<br>1025                      | 195047           | 1090.8                | 194818                     | 1092.5                           |    |      |    |      |
| STS-42 | 103<br>(14)        | 178203       | 6341                                    | 14469       | 1908     | 4974 | 211062                          | 0<br>26453                   | 0                   | 0            | 2210         | 28663<br>3701                   | 32364                            | 639991<br>530075   | 1326328            | 243456                | 231497                     | 8783911                        | 1664527                            | 1300167<br>1299324                  | 4507474                                     | 2511<br>2716                     | 218159           | 1080.6                | 218089                     | 1082.2                           |    |      |    |      |
| STS-45 | 104<br>(11)        | 177732       | 6337                                    | 16894       | 2180     | 4970 | 213279                          | 0<br>15538                   | 0                   | 0            | 2145         | 17683<br>2658                   | 20341                            | 639991<br>547758   | 1346669            | 233650                | 222086                     | 9005997                        | 1664861                            | 1298457<br>1298957                  | 4496035                                     | 11017<br>10427                   | 205672           | 1085.4                | 205588                     | 1087.2                           |    |      |    |      |
| STS-49 | 105<br>(1)         | 180161       | 6197                                    | 19916       | 2448     | 4971 | 218859                          | 23346<br>8766                | 0                   | 0            | 697          | 32809<br>4635                   | 37444                            | 663337<br>557221   | 1384113            | 256333                | 246008                     | 9252005                        | 1664838                            | 1299195<br>1298788                  | 4519154                                     | 3351<br>3206                     | 201400           | 1084.4                | 201235                     | 1086.2                           |    |      |    |      |
| STS-50 | 102<br>(12)        | 186622       | 9760                                    | 16830       | 1903     | 4967 | 225218                          | 0<br>22126                   | 0                   | 0            | 2179         | 24305<br>8142                   | 32447                            | 663337<br>581526   | 1416560            | 257695                | 245902                     | 9497907                        | 1664945                            | 1298413<br>1299050                  | 4520103                                     | 2940<br>3276                     | 225865           | 1077.7                | 225615                     | 1079.1                           |    |      |    |      |
| STS-46 | 104<br>(12)        | 178089       | 6380                                    | 24887       | 2451     | 4968 | 221941                          | 9901<br>16094                | 1486<br>1396        | 0            | 1104         | 28585<br>5475                   | 34060                            | 673238<br>598724   | 1450620            | 256031                | 241797                     | 9739704                        | 1664720                            | 1297746<br>1298292                  | 4516789                                     | 2825<br>1942                     | 209851           | 1078.2                | 209532                     | 1079.6                           |    |      |    |      |
| STS-47 | 105<br>(2)         | 179161       | 6286                                    | 14559       | 1917     | 4979 | 212058                          | 0<br>26247                   | 0                   | 0            | 1845         | 28092<br>4388                   | 32480                            | 673238<br>626816   | 1483100            | 244568                | 232661                     | 9972365                        | 1664720                            | 1298225<br>1299291                  | 4506804                                     | 1348<br>2887                     | 220325           | 1083.7                | 220195                     | 1085.3                           |    |      |    |      |
| STS-52 | 102<br>(13)        | 186650       | 7127                                    | 17398       | 2163     | 4974 | 223478                          | 5577<br>12475                | 0                   | 0            | 2080         | 20132<br>6730                   | 26862                            | 678815<br>641371   | 1509962            | 250370                | 239178                     | 10211543                       | 1664613                            | 1299187<br>1300395                  | 4514565                                     | 10788<br>9801                    | 216043           | 1082.6                | 215935                     | 1084.3                           |    |      |    |      |
| STS-53 | 103<br>(15)        | 179035       | 5874                                    | 18600       | 1912     | 4964 | 215551                          | 20789<br>4299                | 0                   | 0            | 1030         | 26118<br>2198                   | 28316                            | 699604<br>646700   | 1538278            | 243897                | 230731                     | 10442274                       | 1664985                            | 1299174<br>1298531                  | 4506587                                     | 1368<br>2844                     | 194028           | 1089.5                | 193851                     | 1091.3                           |    |      |    |      |
| STS-54 | 105<br>(3)         | 178558       | 5895                                    | 14278       | 1925     | 4980 | 210802                          | 37497<br>7991                | 0                   | 0            | 1052         | 46540<br>2499                   | 49039                            | 737101<br>655743   | 1587317            | 259871                | 248338                     | 10690612                       | 1664458                            | 1299819<br>1299151                  | 4523299                                     | 2659<br>3421                     | 197481           | 1091.6                | 197353                     | 1093.4                           |    |      |    |      |
| STS-56 | 103<br>(16)        | 179811       | 6287                                    | 17526       | 2456     | 4967 | 216223                          | 0<br>12568                   | 2840<br>2798        | 0            | 1031         | 16439<br>4561                   | 21003                            | 737101<br>669342   | 1608317            | 237253                | 225597                     | 10916209                       | 1664388                            | 1299765<br>1300514                  | 4501920                                     | 9521<br>10714                    | 208052           | 1084.6                | 207946                     | 1086.3                           |    |      |    |      |
| STS-55 | 102<br>(14)        | 186929       | 7345                                    | 15687       | 1928     | 4967 | 222022                          | 0<br>24599                   | 0                   | 0            | 2282         | 26881<br>6535                   | 33416                            | 737101<br>696223   | 1641733            | 255468                | 244156                     | 11160365                       | 1664456                            | 1298515<br>1300561                  | 4519000                                     | 6248<br>7559                     | 227484           | 1078.4                | 227209                     | 1079.7                           |    |      |    |      |
| STS-57 | 105<br>(4)         | 179410       | 6412                                    | 25147       | 2450     | 4969 | 223554                          | 132<br>18244                 | 0                   | 9424         | 1254         | 19630<br>9489                   | 29119                            | 737233<br>715721   | 1670852            | 252703                | 239319                     | 11399684                       | 1664332                            | 1300548<br>1300983                  | 4518566                                     | 2030<br>2162                     | 224752           | 1081.1                | 224468                     | 1082.5                           |    |      |    |      |

APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY  
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT | ORBITER            |              |   |             |          |      |                                 | CARGO                        |                     |              |              |                                 |                          |                               | ORBITER TOTALS |                       |                            | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER                          |                  | ORBITER       |        |        |
|--------|--------------------|--------------|---|-------------|----------|------|---------------------------------|------------------------------|---------------------|--------------|--------------|---------------------------------|--------------------------|-------------------------------|----------------|-----------------------|----------------------------|--------------------------------|------------------------------------|-------------------------------------|---|----------------------------------|------------------|---------------|--------|--------|
|        | TAIL<br>NO.<br>OV- | W/O<br>CONS. | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |      | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS       |                     |              |              |                                 | FLIGHT<br>CARGO<br>TOTAL | ACCUMULATED                   |                | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT |                                |                                    |                                     |   | ACCUM<br>WT @<br>ORBIT<br>INSERT | AT<br>MACH 3 EOM | AT<br>LANDING |        |        |
|        |                    |              |   |             | FWD      | AFT  |                                 | PRI<br>DPLY/<br>NON-<br>DPLY | DPLY<br>AND<br>RETR | RETR<br>ONLY | MID-<br>DECK | CHARGE-<br>ABLE<br>PYLD/<br>STS |                          | PYLD<br>DPLY/<br>NON-<br>DPLY | CARGO<br>TOTAL |                       |                            |                                |                                    |                                     |   |                                  |                  | WT            | X CG   | WT     |
| STS-51 | 103<br>(17)        | 179422       | 6003                                    | 16743       | 2451     | 4978 | 214763                          | 26889<br>7305                | 7321                | 0            | 1122         | 42637<br>4048                   | 46685                    | 764122<br>724148              | 1717537        | 261487                | 250023                     | 11649708                       | 1664649                            | 1298328<br>1298670                  | 4523125                                     | 1358<br>1273                     | 207043           | 1084.8        | 206932 | 1086.5 |
| STS-58 | 102<br>(15)        | 187669       | 9789                                    | 14520       | 1945     | 4975 | 224062                          | 0<br>21754                   | 0                   | 0            | 1373         | 23127<br>8884                   | 32011                    | 764122<br>747275              | 1749548        | 256103                | 244860                     | 11894568                       | 1664337                            | 1298196<br>1298502                  | 4517138                                     | 767<br>1114                      | 229481           | 1078.8        | 229369 | 1080.4 |
| STS-61 | 105<br>(5)         | 181308       | 7000                                    | 24989       | 2451     | 4971 | 225885                          | 2308<br>14428                | 0                   | 2148         | 665          | 17401<br>6962                   | 24363                    | 766430<br>762368              | 1773911        | 250279                | 236670                     | 12131238                       | 1664521                            | 1298559<br>1298436                  | 4511794                                     | 927<br>554                       | 212947           | 1078.9        | 212836 | 1080.6 |
| STS-60 | 103<br>(18)        | 179635       | 6510                                    | 18045       | 2450     | 4972 | 216778                          | 171<br>21015                 | *0                  | 0            | 1110         | 22296<br>6661                   | 28957                    | 766601<br>784493              | 1802868        | 245765                | 233290                     | 12364528                       | 1664515                            | 1298776<br>1298783                  | 4508839                                     | 110<br>306                       | 216663           | 1079.6        | 216595 | 1081.3 |
| STS-62 | 102<br>(16)        | 187779       | 9733                                    | 16797       | 2091     | 4968 | 226533                          | 0<br>18512                   | 0                   | 0            | 1280         | 19792<br>10224                  | 30016                    | 766601<br>804285              | 1832884        | 256579                | 245457                     | 12609985                       | 1664370                            | 1299668<br>1299184                  | 4519801                                     | 871<br>1795                      | 228360           | 1082.6        | 228250 | 1084.1 |
| STS-59 | 105<br>(6)         | 180488       | 7220                                    | 13287       | 1924     | 4976 | 213061                          | 0<br>26002                   | 0                   | 0            | 1445         | 27447<br>6311                   | 33758                    | 766601<br>831732              | 1866642        | 246849                | 237048                     | 12847033                       | 1664202                            | 1300061<br>1300299                  | 4511411                                     | 2856<br>1731                     | 221981           | 1079.6        | 221865 | 1081.2 |
| STS-65 | 102<br>(17)        | 188398       | 9567                                    | 16385       | 1898     | 4975 | 226389                          | 0<br>22521                   | 0                   | 0            | 1761         | 24282<br>8598                   | 32880                    | 766601<br>856014              | 1899522        | 259296                | 247778                     | 13094811                       | 1664460                            | 1299585<br>1300097                  | 4523441                                     | 2169<br>3531                     | 229368           | 1078.6        | 229261 | 1080.1 |
| STS-64 | 103<br>(19)        | 180122       | 6286                                    | 16789       | 2451     | 4969 | 215783                          | 0<br>16212                   | 2842<br>2800        | 0            | 1363         | 20417<br>5204                   | 25621                    | 766601<br>873589              | 1925143        | 241439                | 230743                     | 13325554                       | 1664420                            | 1298946<br>1299121                  | 4503921                                     | 6409<br>9639                     | 212294           | 1082.3        | 212180 | 1083.9 |
| STS-68 | 105<br>(7)         | 180520       | 7225                                    | 13321       | 1913     | 4976 | 213121                          | 0<br>25997                   | 0                   | 0            | 1643         | 27640<br>6612                   | 34252                    | 766601<br>901229              | 1959395        | 247404                | 237742                     | 13563296                       | 1664393                            | 1299294<br>1299523                  | 4510613                                     | 1721<br>2071                     | 221784           | 1078.7        | 221673 | 1080.4 |
| STS-66 | 104<br>(13)        | 180096       | 7163                                    | 20801       | 2448     | 4974 | 220648                          | 0<br>9901                    | 7154<br>7011        | 0            | 1080         | 18135<br>5426                   | 23560                    | 766601<br>912210              | 1982955        | 244238                | 232278                     | 13795574                       | 1664386                            | 1299860<br>1300231                  | 4508715                                     | 3284<br>3158                     | 211562           | 1084.4        | 211411 | 1086.1 |
| STS-63 | 103<br>(20)        | 179828       | 6285                                    | 23979       | 2454     | 4980 | 222692                          | 23<br>15249                  | 2651<br>2617        | 0            | 1128         | 19051<br>5852                   | 24903                    | 766624<br>928587              | 2007858        | 247630                | 235671                     | 14031245                       | 1664161                            | 1299714<br>1300130                  | 4511630                                     | 1830<br>3476                     | 212775           | 1079.5        | 212693 | 1081.2 |
| STS-67 | 105<br>(8)         | 180588       | 10610                                   | 24154       | 2447     | 4972 | 227937                          | 0<br>18303                   | 0                   | 0            | 1764         | 20067<br>8461                   | 28528                    | 766624<br>948654              | 2036386        | 256495                | 243809                     | 14275054                       | 1664446                            | 1299857<br>1299389                  | 4520187                                     | 4099<br>6754                     | 217646           | 1083.5        | 217437 | 1085.0 |
| STS-71 | 104<br>(14)        | 180545       | 7390                                    | 21956       | 2452     | 4972 | 222481                          | 0<br>17251                   | 0                   | 476          | 690          | 17941<br>8636                   | 26577                    | 766624<br>966595              | 2062963        | 249089                | 238682                     | 14513736                       | 1664561                            | 1299083<br>1298854                  | 4511586                                     | 1040<br>1398                     | 216527           | 1079.7        | 216352 | 1081.3 |
| STS-70 | 103<br>(21)        | 179039       | 5537                                    | 15110       | 1921     | 4982 | 211755                          | 37774<br>5585                | 0                   | 0            | 1086         | 44445<br>2354                   | 46799                    | 804398<br>973266              | 2109762        | 258584                | 247141                     | 14760877                       | 1664631                            | 1299218<br>1299339                  | 4521772                                     | 3789<br>5299                     | 194267           | 1097.2        | 194190 | 1099.1 |
| STS-69 | 105<br>(9)         | 180072       | 7149                                    | 24993       | 2452     | 4973 | 224805                          | 0<br>16739                   | 7306<br>7258        | 0            | 1301         | 25346<br>6203                   | 31549                    | 804398<br>991306              | 2141311        | 256385                | 243328                     | 15004205                       | 1664169                            | 1299385<br>1299176                  | 4519114                                     | 5409<br>7966                     | 219395           | 1080.7        | 219298 | 1082.3 |
| STS-73 | 102<br>(18)        | 188174       | 10734                                   | 12653       | 1883     | 4972 | 223592                          | 0<br>23302                   | 0                   | 0            | 2008         | 25310<br>8395                   | 33705                    | 804398<br>1016616             | 2175016        | 257321                | 246718                     | 15250923                       | 1664190                            | 1299554<br>1300510                  | 4521581                                     | 1906<br>4902                     | 230603           | 1080.7        | 230479 | 1082.3 |
| STS-74 | 104<br>(15)        | 179624       | 7175                                    | 25155       | 2453     | 4976 | 224549                          | 10015<br>3135                | 0                   | 690          | 914          | 14064<br>9623                   | 23687                    | 814413<br>1020665             | 2198703        | 248266                | 237141                     | 15488064                       | 1664354                            | 1299872<br>1299903                  | 4512395                                     | 1823<br>3689                     | 202767           | 1078.7        | 202718 | 1080.6 |
| STS-72 | 105<br>(10)        | 181188       | 7149                                    | 25038       | 2452     | 4970 | 225963                          | 0<br>10546                   | 2643                | 10459        | 898          | 14087<br>6931                   | 21018                    | 814413<br>1032109             | 2219721        | 247011                | 238498                     | 15726562                       | 1664138                            | 1302278<br>1301220                  | 4514647                                     | 11447<br>13346                   | 218496           | 1081.7        | 218345 | 1083.3 |
| STS-75 | 102<br>(19)        | 188372       | 9386                                    | 19109       | 2452     | 4970 | 229455                          | 1494<br>20490                | *0                  | 0            | 1369         | 23353<br>8653                   | 32006                    | 815907<br>1053968             | 2251727        | 261491                | 250226                     | 15976788                       | 1663825                            | 1300542<br>1300635                  | 4526493                                     | 1594<br>638                      | 226443           | 1079.4        | 226287 | 1080.9 |

\* NOTE: DEPLOYED, NON-DEPLOYED, AND DEPLOYED/RETRIEVED REFLECT ACTUALS, E.G., WSF WAS NOT DEPLOYED AND RETRIEVED ON STS-60; TSS WAS LEFT IN SPACE ON STS-75.



APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT | ORBITER            |              |   |             |          |      |                                 | CARGO                        |                     |              |              |                                 |                          |                               | ORBITER TOTALS |                       |                            | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER<br>AT<br>MACH 3 EOM      |        | ORBITER<br>AT<br>LANDING |        |        |
|--------|--------------------|--------------|---|-------------|----------|------|---------------------------------|------------------------------|---------------------|--------------|--------------|---------------------------------|--------------------------|-------------------------------|----------------|-----------------------|----------------------------|--------------------------------|------------------------------------|-------------------------------------|---|----------------------------------|--------|--------------------------|--------|--------|
|        | TAIL<br>NO.<br>OV- | W/O<br>CONS. | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |      | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS       |                     |              |              |                                 | FLIGHT<br>CARGO<br>TOTAL | ACCUMULATED                   |                | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT |                                |                                    |                                     |   | ACCUM<br>WT @<br>ORBIT<br>INSERT | WT     | X CG                     | WT     | X CG   |
|        |                    |              |   |             | FWD      | AFT  |                                 | PRI<br>DPLY/<br>NON-<br>DPLY | DPLY<br>AND<br>RETR | RETR<br>ONLY | MID-<br>DECK | CHARGE-<br>ABLE<br>PYLD/<br>STS |                          | PYLD<br>DPLY/<br>NON-<br>DPLY | CARGO<br>TOTAL |                       |                            |                                |                                    |                                     |   |                                  |        |                          |        |        |
| STS-76 | 104<br>(16)        | 180112       | 7216                                    | 21664       | 2451     | 4976 | 221585                          | 2814<br>10578                | 0                   | 736          | 760          | 14152<br>10453                  | 24605                    | 818721<br>1065306             | 2276332        | 246222                | 238531                     | 16215319                       | 1664159                            | 1299899<br>1299353                  | 4509631                                     | 3140<br>3563                     | 211913 | 1082.8                   | 211805 | 1084.5 |
| STS-77 | 105<br>(11)        | 180204       | 7235                                    | 19483       | 2453     | 4976 | 219518                          | 1104<br>23586                | 1837<br>1820        | 0            | 866          | 27393<br>7812                   | 35205                    | 819825<br>1089758             | 2311537        | 254753                | 243818                     | 16459137                       | 1664470                            | 1300764<br>1299175                  | 4519162                                     | 5381<br>8528                     | 222399 | 1080.5                   | 222276 | 1082.0 |
| STS-78 | 102<br>(20)        | 188422       | 10876                                   | 13227       | 1940     | 4979 | 224611                          | 0<br>21598                   | 0                   | 0            | 2066         | 23666<br>8188                   | 31854                    | 819825<br>1113422             | 2343391        | 256495                | 245723                     | 16704860                       | 1664859                            | 1297868<br>1298255                  | 4517477                                     | 3683<br>4245                     | 229134 | 1081.9                   | 228986 | 1083.4 |
| STS-79 | 104<br>(17)        | 180241       | 7286                                    | 21473       | 2450     | 4971 | 221598                          | 3170<br>15151                | 0                   | 2126         | 718          | 19039<br>8773                   | 27812                    | 822995<br>1129291             | 2371203        | 249440                | 241776                     | 16946636                       | 1664353                            | 1297828<br>1298848                  | 4510469                                     | 462<br>716                       | 215990 | 1081.3                   | 215904 | 1083.0 |
| STS-80 | 102<br>(21)        | 187805       | 9760                                    | 20528       | 2451     | 4975 | 230676                          | 0<br>7575                    | 12524<br>12427      | 0            | 1109         | 21208<br>9903                   | 31111                    | 822995<br>1137975             | 2402314        | 261817                | 248721                     | 17195357                       | 1663927                            | 1299137<br>1299854                  | 4524735                                     | 487<br>1103                      | 227815 | 1079.1                   | 227670 | 1080.6 |
| STS-81 | 104<br>(18)        | 180533       | 7284                                    | 21574       | 2452     | 4978 | 221988                          | 4019<br>14492                | 0                   | 2842         | 810          | 19321<br>8828                   | 28149                    | 827014<br>1153277             | 2430463        | 250167                | 242178                     | 17437535                       | 1663879                            | 1298753<br>1298212                  | 4511011                                     | 1286<br>2118                     | 215403 | 1081.4                   | 215337 | 1083.1 |
| STS-82 | 103<br>(22)        | 182897       | 6572                                    | 25010       | 2448     | 4971 | 227065                          | 6941<br>9921                 | 0                   | 6638         | 512          | 17374<br>7517                   | 24891                    | 833955<br>1163710             | 2455354        | 251986                | 239583                     | 17677118                       | 1663879                            | 1299604<br>1298386                  | 4513855                                     | 3503<br>4235                     | 213949 | 1077.8                   | 213869 | 1079.6 |
| STS-83 | 102<br>(22)        | 187924       | 10876                                   | 15000       | 1912     | 4970 | 225849                          | 0<br>23536                   | 0                   | 0            | 2020         | 25556<br>8817                   | 34373                    | 833955<br>1189266             | 2489727        | 259963                | 248526                     | 17925644                       | 1663889                            | 1299392<br>1299392                  | 4522925                                     | 4820<br>3741                     | 235510 | 1078.5                   | 235421 | 1080.0 |
| STS-84 | 104<br>(19)        | 179665       | 7163                                    | 21674       | 2455     | 4973 | 221097                          | 3902<br>14605                | 0                   | 2576         | 1136         | 19643<br>8854                   | 28497                    | 837857<br>1205007             | 2518224        | 249624                | 241827                     | 18167471                       | 1663879                            | 1298206<br>1298123                  | 4509832                                     | 938<br>868                       | 216169 | 1081.0                   | 216021 | 1082.6 |
| STS-94 | 102<br>(23)        | 187901       | 10876                                   | 15058       | 1918     | 4968 | 225890                          | 0<br>23536                   | 0                   | 0            | 2032         | 25568<br>8791                   | 34359                    | 837857<br>1230575             | 2552583        | 260279                | 248956                     | 18416427                       | 1664630                            | 1297078<br>1297346                  | 4519333                                     | 2845<br>4193                     | 230818 | 1078.4                   | 230773 | 1080.1 |
| STS-85 | 103<br>(23)        | 181354       | 7072                                    | 17089       | 2450     | 4978 | 218082                          | 0<br>15666                   | 7726<br>7587        | 0            | 1590         | 24982<br>6977                   | 31959                    | 837857<br>1247831             | 2584542        | 250101                | 238142                     | 18654569                       | 1664460                            | 1298435<br>1299129                  | 4512125                                     | 1446<br>3065                     | 221335 | 1082.0                   | 221264 | 1083.6 |
| STS-86 | 104<br>(20)        | 180477       | 7283                                    | 21682       | 2451     | 4975 | 222037                          | 6058<br>14379                | 0                   | 2859         | 602          | 21039<br>8689                   | 29728                    | 843915<br>1262812             | 2614270        | 251795                | 241773                     | 18896342                       | 1664491                            | 1297660<br>1298078                  | 4512024                                     | 1756<br>81                       | 215387 | 1081.3                   | 215303 | 1083.0 |
| STS-87 | 102<br>(24)        | 188297       | 10459                                   | 16179       | 2188     | 4978 | 227270                          | 0<br>17496                   | 2998<br>2998        | 0            | 1452         | 21946<br>12448                  | 34394                    | 843915<br>1281760             | 2648665        | 261664                | 250693                     | 19147035                       | 1664353                            | 1297733<br>1298120                  | 4521900                                     | 4384<br>6115                     | 232930 | 1081.0                   | 232849 | 1082.6 |
| STS-89 | 105<br>(12)        | 182187       | 7059                                    | 20679       | 2450     | 4972 | 222513                          | 4596<br>16699                | 0                   | 3508         | 868          | 22163<br>5877                   | 28040                    | 848511<br>1299327             | 2676705        | 250583                | 239584                     | 19386619                       | 1664543                            | 1298227<br>1298526                  | 4511879                                     | 2309<br>3544                     | 217475 | 1086.5                   | 217422 | 1088.2 |
| SYS-90 | 102<br>(25)        | 187562       | 10884                                   | 15763       | 1841     | 4972 | 226191                          | 0<br>23865                   | 0                   | 0            | 2340         | 26205<br>9844                   | 36049                    | 848511<br>1325532             | 2712754        | 262270                | 247955                     | 19634574                       | 1663992                            | 1298901<br>1298520                  | 4523683                                     | 3162<br>1999                     | 233031 | 1080.3                   | 232979 | 1081.9 |
| STS-91 | 103<br>(24)        | 182624       | 7273                                    | 21882       | 2450     | 4976 | 224374                          | 2419<br>22315                | 0                   | 2964         | 891          | 25625<br>9944                   | 35549                    | 850933<br>1348738             | 2748303        | 259973                | 249580                     | 19884154                       | 1658766                            | 1298618<br>1297292                  | 4514649                                     | 631<br>403                       | 226968 | 1079.5                   | 226872 | 1081.1 |
| STS-95 | 103<br>(25)        | 182647       | 7085                                    | 25032       | 2294     | 4980 | 227207                          | 125<br>24108                 | 2973<br>2945        | 0            | 1314         | 28520<br>10098                  | 38618                    | 851055<br>1374160             | 2786921        | 265855                | 247947                     | 20132101                       | 1658996                            | 1297332<br>1298008                  | 4520191                                     | 1587<br>2740                     | 228455 | 1076.8                   | 228388 | 1079.5 |
| STS-88 | 105<br>(13)        | 182065       | 6997                                    | 24612       | 2451     | 4971 | 226265                          | 26791<br>3073                | 0                   | 335          | 1122         | 30986<br>6745                   | 37731                    | 877846<br>1378355             | 2824652        | 264026                | 251336                     | 20383437                       | 1658691                            | 1297827<br>1297945                  | 4518489                                     | 2365<br>1043                     | 201538 | 1084.3                   | 201492 | 1086.2 |
| STS-96 | 103<br>(26)        | 183197       | 7174                                    | 25007       | 2450     | 4977 | 227974                          | 4228<br>17994                | 0                   | 213          | 1034         | 22707<br>11101                  | 33808                    | 882074<br>1397383             | 2858460        | 261812                | 245256                     | 20628693                       | 1658803                            | 1297048<br>1296568                  | 4514231                                     | 4435<br>4306                     | 222366 | 1080.2                   | 222299 | 1081.8 |

\* NOTE: STS-91 WAS FIRST FLIGHT OF SLWT, 59212 LBS. STS-95 WAS SECOND FLIGHT OF SLWT, 59942 LBS. STS-88 WAS THIRD FLIGHT OF SLWT, 59137 LBS. STS-89 ET WEIGHED 66353 LBS.

APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY  
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT  | ORBITER            |              |   |             |          |      |                                 | CARGO                        |                     |              |              |                                 |                                  |                               |                    | ORBITER TOTALS        |                            |                                  | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER          |              | ORBITER      |              |
|---------|--------------------|--------------|---|-------------|----------|------|---------------------------------|------------------------------|---------------------|--------------|--------------|---------------------------------|----------------------------------|-------------------------------|--------------------|-----------------------|----------------------------|----------------------------------|--------------------------------|------------------------------------|-------------------------------------|---|------------------|--------------|--------------|--------------|
|         | TAIL<br>NO.<br>OV- | W/O<br>CONS. | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |      | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS       |                     |              |              |                                 | FLIGHT<br><br>CARGO<br><br>TOTAL | ACCUMULATED                   |                    | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT | ACCUM<br>WT @<br>ORBIT<br>INSERT |                                |                                    |                                     |   | AT<br>MACH 3 EOM | WT           | X CG         |              |
|         |                    |              |   |             | FWD      | AFT  |                                 | PRI<br>DPLY/<br>NON-<br>DPLY | DPLY<br>AND<br>RETR | RETR<br>ONLY | MID-<br>DECK | CHARGE-<br>ABLE<br>PYLD/<br>STS |                                  | PYLD<br>DPLY/<br>NON-<br>DPLY | CARGO<br><br>TOTAL |                       |                            |                                  |                                |                                    |                                     |   |                  |              |              | X CG         |
|         |                    |              |   |             |          |      |                                 |                              |                     |              |              |                                 |                                  |                               |                    |                       |                            |                                  |                                |                                    |                                     |   |                  |              |              |              |
| STS-93  | 102<br>(26)        | 185743       | 4820                                    | 14814       | 2473     | 4976 | 217975                          | 43080<br>5171                | 0                   | 0            | 1538         | 49789<br>2593                   | 52382                            | 925154<br>1404092             | 2910842            | 270387                | 258911                     | 20887604                         | 1658826                        | 1297760<br>1297999                 | 4524972                             | 2081<br>-3981                               | 202872           | 1097.5       | 202796       | 1099.4       |
| STS-103 | 103<br>(27)        | 183199       | 7065                                    | 24990       | 2451     | 4979 | 227853                          | 5423<br>6451                 | 0                   | 5351         | 1334         | 13208<br>7068                   | 20276                            | 930577<br>1411877             | 2931118            | 248159                | 236285                     | 21123889                         | 1658784                        | 1299709<br>1299767                 | 4506419                             | 13576<br>13388                              | 212288           | 1080.6       | 212217       | 1082.4       |
| STS-99  | 105<br>(14)        | 182260       | 6989                                    | 19605       | 2308     | 4968 | 221299                          | 260<br>26987                 | 0                   | 0            | 1822         | 29069<br>6341                   | 35410                            | 930837<br>1440686             | 2966528            | 256739                | 242322                     | 21366211                         | 1664331                        | 1299767<br>1299817                 | 4520450                             | 1085<br>395                                 | 225092           | 1078.5       | 225030       | 1080.2       |
| STS-101 | 104<br>(21)        | 183166       | 7235                                    | 23891       | 2453     | 4980 | 226894                          | 3371<br>20159                | 0                   | 1391         | 1262         | 24733<br>10871                  | 35604                            | 934208<br>1462107             | 3002132            | 262528                | 252056                     | 21618267                         | 1658873                        | 1299223<br>1298831                 | 4519455                             | 1480<br>988                                 | 226277           | 1081.2       | 226212       | 1082.9       |
| STS-106 | 104<br>(22)        | 183426       | 7235                                    | 23786       | 2449     | 4978 | 227032                          | 5399<br>17935                | 0                   | 948          | 1172         | 23967<br>11024                  | 34991                            | 939607<br>1481214             | 3037123            | 262053                | 253389                     | 21871656                         | 1658741                        | 1299561<br>1298823                 | 4519178                             | 1940<br>317                                 | 222835           | 1080.1       | 222774       | 1081.7       |
| STS-92  | 103<br>(28)        | 183363       | 7235                                    | 24629       | 2447     | 4968 | 227808                          | 21998<br>4678                | 0                   | 293          | 1333         | 28009<br>7241                   | 35250                            | 961605<br>1487225             | 3072373            | 263088                | 253459                     | 22125115                         | 1658781                        | 1299531<br>1299149                 | 4520549                             | 1532<br>2330                                | 205188           | 1080.0       | 205129       | 1081.8       |
| STS-97* | 105<br>(15)        | 181992       | 6989                                    | 22156       | 2452     | 4971 | 223736                          | 36376<br>719                 | 0                   | 227          | 1021         | 37496<br>5308                   | 42804                            | 997981<br>1488965             | 3115177            | 266570                | 253646                     | 22378761                         | 1658695                        | 1299246<br>1300085                 | 4524795<br>*                        | 1920<br>2032                                | 197829           | 1085.9       | 197781       | 1087.7       |
| STS-98  | 104<br>(23)        | 182605       | 7055                                    | 22904       | 2227     | 4978 | 224935                          | 32270<br>583                 | 0                   | 872          | 987          | 33286<br>5876                   | 39162                            | 1030251<br>1490535            | 3154339            | 264127                | 251033                     | 22629794                         | 1658647                        | 1298270<br>1298137                 | 4519380                             | 2138<br>1538                                | 197909           | 1083.1       | 197854       | 1082.0       |
| STS-102 | 103<br>(29)        | 182881       | 7055                                    | 24940       | 2452     | 4975 | 227469                          | 9649<br>3517                 | 0                   | 1086         | 472          | 28739<br>8559                   | 37328                            | 1039900<br>1494524            | 3191667            | 264797                | 253436                     | 22883230                         | 1658484                        | 1299774<br>1298555                 | 4521809                             | 2847<br>3031                                | 218094           | 1083.2       | 218031       | 1084.9       |
| STS-100 | 105<br>(16)        | 182943       | 7301                                    | 24075       | 2451     | 4972 | 226908                          | 6346<br>4282                 | 0                   | 1608         | 781          | 29472<br>8858                   | 38330                            | 1046246<br>1499587            | 3229997            | 265268                | 253063                     | 23136293                         | 1658593                        | 1298945<br>1299241                 | 4522246                             | 2670<br>2296                                | 220623           | 1083.8       | 220556       | 1085.5       |
| STS-104 | 104<br>(24)        | 182862       | 7301                                    | 25033       | 2452     | 4975 | 227787                          | 19782<br>6060                | 0                   | 626          | 582          | 26424<br>8711                   | 35135                            | 1066028<br>1506229            | 3265132            | 262952                | 254358                     | 23390651                         | 1658552                        | 1298897<br>1299559                 | 4520159                             | 2884<br>2990                                | 209142           | 1083.8       | 209097       | 1085.6       |
| STS-105 | 103<br>(30)        | 182831       | 7055                                    | 23428       | 1886     | 4974 | 225340                          | 9657<br>4654                 | 0                   | 3802         | 475          | 29305<br>7802                   | 37107                            | 1075685<br>1511358            | 3298239            | 262477                | 253897                     | 23644548                         | 1658085                        | 1298852<br>1298417                 | 4518170                             | 705<br>631                                  | 222682           | 1081.0       | 222620       | 1085.6       |
| STS-108 | 105<br>(17)        | 182106       | 7058                                    | 25057       | 2452     | 4972 | 226711                          | 6454<br>8635                 | 0                   | 4156         | 690          | 31393<br>6784                   | 38177                            | 1082139<br>1520683            | 3336416            | 264918                | 252854                     | 23897402                         | 1657831                        | 1298263<br>1298521                 | 4519872                             | 2381<br>1182                                | 220623           | 1083.8       | 220556       | 1085.5       |
| STS-109 | 102<br>(27)        | 188444       | 6969                                    | 25066       | 2451     | 4975 | 233071                          | 8256<br>10672                | 0                   | 6409         | 1216         | 20144<br>7420                   | 27564                            | 1090395<br>1532571            | 3363980            | 260665                | 250970                     | 24148372                         | 1658065                        | 1298219<br>1298358                 | 4515646                             | 3309<br>4170                                | 222447           | 1082.9       | 222366       | 1084.6       |
| STS-110 | 104<br>(25)        | 184160       | 7060                                    | 25072       | 2451     | 4975 | 228854                          | 30600<br>0                   | 0                   | 2607         | 757          | 28379<br>7470                   | 35849                            | 1120995<br>1533328            | 3399829            | 264763                | 253486                     | 24401858                         | 1658030                        | 1298947<br>1298885                 | 4520964                             | 1256<br>2670                                | 201513           | 1085.3       | 201463       | 1087.2       |
| STS-111 | 105<br>(18)        | 183220       | 7060                                    | 25059       | 2454     | 4976 | 227935                          | 9512<br>906                  | 0                   | 6342         | 288          | 29712<br>6370                   | 36082                            | 1130507<br>1534522            | 3435911            | 264047                | 253522                     | 24655380                         | 1657969                        | 1297561<br>1298161                 | 4518077                             | 2484<br>1870                                | 220234           | 1083.6       | 220279       | 1085.3       |
| STS-112 | 104<br>(26)        | 183924       | 7060                                    | 25043       | 2179     | 4869 | 228341                          | 29543<br>0                   | 0                   | 1839         | 381          | 29502<br>7939                   | 37441                            | 1160050<br>1534904            | 3473352            | 265812                | 254269                     | 2490949                          | 1658013                        | 1298072<br>1299078                 | 4521314                             | 2744<br>3860                                | 202688           | 1087.1       | 202621       | 1088.9       |
| STS-113 | 105<br>(19)        | 183037       | 7060                                    | 25064       | 2254     | 4970 | 227551                          | 29672<br>46                  | 0                   | 2250         | 288          | 30217<br>8176                   | 38393                            | 1189722<br>1535238            | 3511745            | 265974                | 250282                     | 25159931                         | 1658011                        | 1298806<br>1298119                 | 4521249                             | 1736<br>2486                                | 200993           | 1087.6       | 200939       | 1089.5       |
| STS-107 | 102<br>(28)        | 189487       | 10160                                   | 17619       | 2180     | 4976 | 229588                          | 0<br>23515                   | 0                   | 0            | 801          | 24316<br>11147                  | 35463                            | 1189722<br>1559554            | 3547208            | 265081                | 250270                     | 25410201                         | 1663352                        | 1298648<br>1298614                 | 4526034                             | 1335<br>1348                                | 234495<br>**     | 1078.5<br>** | 234167<br>** | 1077.9<br>** |

\* Beginning with STS-97 the TDDP included an item for “RECONSTRUCTED ASCENT PERFORMANCE COLLECTOR” in the “Shuttle Total Weight at SRB Igniton”.

\*\* WT & CG ARE AT EI AND EI+15 MINUTES.



APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY  
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT  | ORBITER            |              |   |             |          |      |                                 | CARGO                        |                     |              |              |                                 |                          |                               | ORBITER TOTALS |                       |                            | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER                          |                  | ORBITER               |                            |                                  |    |      |    |      |
|---------|--------------------|--------------|---|-------------|----------|------|---------------------------------|------------------------------|---------------------|--------------|--------------|---------------------------------|--------------------------|-------------------------------|----------------|-----------------------|----------------------------|--------------------------------|------------------------------------|-------------------------------------|---|----------------------------------|------------------|-----------------------|----------------------------|----------------------------------|----|------|----|------|
|         | TAIL<br>NO.<br>OV- | W/O<br>CONS. | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |      | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS       |                     |              |              |                                 | FLIGHT<br>CARGO<br>TOTAL | ACCUMULATED                   |                | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT |                                |                                    |                                     |   | ACCUM<br>WT @<br>ORBIT<br>INSERT | AT<br>MACH 3 EOM | AT                    |                            |                                  |    |      |    |      |
|         |                    |              |   |             | FWD      | AFT  |                                 | PRI<br>DPLY/<br>NON-<br>DPLY | DPLY<br>AND<br>RETR | RETR<br>ONLY | MID-<br>DECK | CHARGE-<br>ABLE<br>PYLD/<br>STS |                          | PYLD<br>DPLY/<br>NON-<br>DPLY | CARGO<br>TOTAL |                       |                            |                                |                                    |                                     |   |                                  |                  | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT | ACCUM<br>WT @<br>ORBIT<br>INSERT | WT | X CG | WT | X CG |
|         |                    |              |   |             |          |      |                                 |                              |                     |              |              |                                 |                          |                               |                |                       |                            |                                |                                    |                                     |   |                                  |                  |                       |                            |                                  |    |      |    |      |
| STS-114 | 103<br>(31)        | 184906       | 7076                                    | 24931       | 2174     | 4972 | 229219                          | 26413<br>3231                | 0                   | 6600         | 163          | 29807<br>8845                   | 38652                    | 1216135<br>1562948            | 3585860        | 267901                | 253950                     | 25664151                       | 1657242                            | 1298074<br>1298565                  | 4523083                                     | 2111<br>3792                     | 225792           | 1086.6                | 225727                     | 1088.2                           |    |      |    |      |
| STS-121 | 103<br>(32)        | 184902       | 7076                                    | 24922       | 2174     | 4968 | 229235                          | 23696<br>5426                | 0                   | 8456         | 158          | 29280<br>8456                   | 37736                    | 1239831<br>1568532            | 3623596        | 267001                | 253267                     | 25917418                       | 1657055                            | 1299220<br>1299312                  | 4523889                                     | 2290<br>N/A<br>(Sensor<br>Fail)  | 226063           | 1084.6                | 225972                     | 1086.3                           |    |      |    |      |
| STS-115 | 104<br>(27)        | 184260       | 6986                                    | 24926       | 2449     | 4970 | 228734                          | 35552<br>0                   | 0                   | 993          | 206          | 35758<br>6090                   | 41848                    | 1275383<br>1568738            | 3665444        | 270612                | 252240                     | 26169658                       | 1657088                            | 1298957<br>1298678                  | 4526580                                     | 1749<br>349                      | 199711           | 1086.0                | 199642                     | 1087.0                           |    |      |    |      |
| STS-116 | 103<br>(33)        | 185153       | 7189                                    | 24959       | 2134     | 4977 | 229555                          | 5748<br>1652                 | 0                   | 806          | 182          | 22502<br>13188                  | 35690                    | 1281131<br>1585492            | 3701134        | 265275                | 250980                     | 26420638                       | 1657123                            | 1298200<br>1298501                  | 4520334                                     | 3768<br>4559                     | 224053           | 1077.5                | 223986                     | 1079.2                           |    |      |    |      |
| STS-117 | 104<br>(28)        | 184487       | 7018                                    | 24298       | 1926     | 4974 | 227846                          | 36393<br>0                   | 0                   | 857          | 200          | 36593<br>6048                   | 42641                    | 1317524<br>1585692            | 3743775        | 270517                | 255388                     | 26676026                       | 1657157                            | 1298138<br>1298472                  | 4525519                                     | 1306<br>1431                     | 199418           | 1084.6                | 199305                     | 1086.8                           |    |      |    |      |
| STS-118 | 105<br>(20)        | 185133       | 7189                                    | 24899       | 2030     | 4975 | 229369                          | 11830<br>11740               | 0                   | 316          | 329          | 23899<br>13491                  | 37390                    | 1329354<br>1597761            | 3781165        | 266789                | 250805                     | 2692831                        | 1657180                            | 1298333<br>1297781                  | 4521318                                     | 1913<br>2435                     | 221740           | 1078.1                | 221660                     | 1079.8                           |    |      |    |      |
| STS-120 | 103<br>(34)        | 185405       | 7108                                    | 22763       | 1885     | 4971 | 227275                          | 33474<br>280                 | 0                   | 1577         | 59           | 33813<br>7059                   | 40872                    | 1362828<br>1598100            | 3822037        | 268177                | 251790                     | 2944621                        | 1657012                            | 1298906<br>1298777                  | 4524107                                     | 2091<br>1880                     | 203069           | 1078.3                | 202989                     | 1083.0                           |    |      |    |      |
| STS-122 | 104<br>(29)        | 184885       | 7042                                    | 20823       | 1914     | 4979 | 226743                          | 30657<br>2162                | 0                   | 2162         | 122          | 32941<br>7355                   | 40296                    | 1393485<br>1600384            | 3862333        | 267069                | 252667                     | 3197288                        | 1657253                            | 1298675<br>1299004                  | 4523236                                     | 2402<br>3435                     | 207013           | 1078.2                | 207215                     | 1080.4                           |    |      |    |      |
| STS-123 | 105<br>(21)        | 185393       | 7108                                    | 22763       | 1928     | 4981 | 227316                          | 29442<br>1132                | 0                   | 4891         | 188          | 30762<br>8153                   | 38915                    | 1422927<br>1601704            | 3901248        | 266261                | 253348                     | 3450636                        | 1657249                            | 1298163<br>1298480                  | 4521388                                     | 2109<br>5128                     | 208916           | 1079.7                | 208762                     | 1081.8                           |    |      |    |      |
| STS-124 | 103<br>(35)        | 185476       | 6868                                    | 22771       | 1923     | 4971 | 227152                          | 33890<br>0                   | 0                   | 1608         | 79           | 33969<br>8028                   | 41997                    | 1456817<br>1601783            | 3943245        | 269179                | 251247                     | 3701883                        | 1656958                            | 1299147<br>1298621                  | 4525140                                     | 1308<br>2513                     | 203605           | 1088.0                | 203755                     | 1089.3                           |    |      |    |      |
| STS-126 | 105<br>(22)        | 185343       | 7108                                    | 22761       | 2187     | 4971 | 227513                          | 30432<br>1760                | 0                   | 19436        | 211          | 32403<br>7068                   | 39471                    | 1487249<br>1603754            | 3982716        | 267014                | 254431                     | 3956314                        | 1657112                            | 1298611<br>1299270                  | 4523242                                     | 1682<br>2329                     | 221787           | 1087.2                | 221712                     | 1089.0                           |    |      |    |      |
| STS-119 | 103<br>(36)        | 185710       | 6808                                    | 22762       | 2162     | 4973 | 227558                          | 32489<br>0                   | 0                   | 1279         | 57           | 32546<br>6542                   | 39088                    | 1519738<br>1603811            | 4021804        | 266676                | 254546                     | 4210860                        | 1656990                            | 1298197<br>1298799                  | 4521897                                     | 1746<br>2016                     | 201795           | 1082.8                | 201713                     | 1084.7                           |    |      |    |      |
| STS-125 | 104<br>(30)        | 186902       | 7087                                    | 24984       | 2450     | 4982 | 231548                          | 4694<br>17560                | 0                   | 3893         | 0            | 22254<br>10164                  | 32418                    | 1524432<br>1621371            | 4054222        | 231548                | 254376                     | 4465236                        | 1657233                            | 1297936<br>1298774                  | 4519550                                     | 1689<br>2499                     | 225509           | 1078.3                | 225469                     | 1080.1                           |    |      |    |      |
| STS-127 | 105<br>(23)        | 185510       | 7108                                    | 22762       | 2204     | 4973 | 227700                          | 24266<br>290                 | 0                   | 9756         | 126          | 24682<br>11571                  | 36253                    | 1548698<br>1621787            | 4090475        | 263983                | 252658                     | 4717894                        | 1657094                            | 1298273<br>1298296                  | 4518787                                     | 2553<br>2734                     | 215900           | 1089.8                | 215817                     | 1091.7                           |    |      |    |      |
| STS-128 | 103<br>(37)        | 185683       | 6586                                    | 22762       | 1934     | 4970 | 227078                          | 30572<br>2331                | 0                   | 19130        | 153          | 33056<br>7549                   | 40605                    | 1579270<br>1624271            | 4131080        | 267713                | 254672                     | 4972566                        | 1657188                            | 1298511<br>1298323                  | 4522876                                     | 1707<br>2077                     | 222200           | 1088.4                | 222148                     | 1090.2                           |    |      |    |      |
| STS-129 | 104<br>(31)        | 185268       | 7042                                    | 22762       | 2205     | 4967 | 227387                          | 27615<br>1404                | 0                   | 1176         | 353          | 29372<br>9521                   | 38893                    | 1606885<br>1626028            | 4169973        | 266310                | 254734                     | 5227300                        | 1657082                            | 1298893<br>1298843                  | 4522269                                     | 2228<br>2041                     | 206917           | 1083.8                | 207200                     | 1084.6                           |    |      |    |      |
| STS-130 | 105<br>(24)        | 185488       | 6397                                    | 22763       | 1918     | 4974 | 226683                          | 34648<br>0                   | 0                   | 1262         | 283          | 34931<br>6025                   | 40956                    | 1641533<br>1626311            | 4210929        | 267669                | 252838                     | 5480138                        | 1657227                            | 1298385<br>1297738                  | 4522160                                     | 1188<br>2828                     | 201138           | 1082.8                | 201084                     | 1084.8                           |    |      |    |      |
| STS-131 | 103<br>(38)        | 186007       | 6392                                    | 22762       | 1931     | 4976 | 227212                          | 30512<br>1388                | 0                   | 21764        | 231          | 32131<br>7385                   | 39516                    | 1672045<br>1627930            | 4250445        | 266758                | 251459                     | 5731597                        | 1657053                            | 1298230<br>1298461                  | 4521643                                     | 1133<br>1491                     | 224257           | 1089.0                | 224206                     | 1090.7                           |    |      |    |      |

APPENDIX A - SPACE SHUTTLE FLIGHT WEIGHT SUMMARY  
(SOURCES: SODB, VOL II Thru STS-57 & DOL TDDP for STS-51 and Beyond)

| FLIGHT  | ORBITER            |              |   |             |          |      | CARGO                           |                              |                     |              |              |                                 |                                  |                               | ORBITER TOTALS     |                       |                            | ET<br>TOTAL<br>@<br>SRB<br>IGN | SRB<br>TOTAL<br>LEFT<br>&<br>RIGHT | SHUTTLE<br>TOTAL<br>@<br>SRB<br>IGN | PERF<br>MARG<br>FINAL<br>TDDP<br>&<br>RECON | ORBITER                          |                  | ORBITER |               |        |
|---------|--------------------|--------------|---|-------------|----------|------|---------------------------------|------------------------------|---------------------|--------------|--------------|---------------------------------|----------------------------------|-------------------------------|--------------------|-----------------------|----------------------------|--------------------------------|------------------------------------|-------------------------------------|---|----------------------------------|------------------|---------|---------------|--------|
|         | TAIL<br>NO.<br>OV- | W/O<br>CONS. | NON-<br>PROP<br>CONS<br>@<br>SRB<br>IGN | OMS<br>PROP | RCS PROP |      | ORB<br>TOTAL<br>@<br>SRB<br>IGN | FLIGHT PAYLOAD WEIGHTS       |                     |              |              |                                 | FLIGHT<br><br>CARGO<br><br>TOTAL | ACCUMULATED                   |                    | WT<br>@<br>SRB<br>IGN | WT<br>@<br>ORBIT<br>INSERT |                                |                                    |                                     |   | ACCUM<br>WT @<br>ORBIT<br>INSERT | AT<br>MACH 3 EOM |         | AT<br>LANDING |        |
|         |                    |              |   |             | FWD      | AFT  |                                 | PRI<br>DPLY/<br>NON-<br>DPLY | DPLY<br>AND<br>RETR | RETR<br>ONLY | MID-<br>DECK | CHARGE-<br>ABLE<br>PYLD/<br>STS |                                  | PYLD<br>DPLY/<br>NON-<br>DPLY | CARGO<br><br>TOTAL |                       |                            |                                |                                    |                                     |   |                                  | WT               | X CG    | WT            | X CG   |
|         |                    |              |   |             |          |      |                                 |                              |                     |              |              |                                 |                                  |                               |                    |                       |                            |                                |                                    |                                     |   |                                  |                  |         |               |        |
| STS-132 | 104<br>(32)        | 185064       | 7042                                    | 22762       | 2166     | 4974 | 227151                          | 26619<br>0                   | 0                   | 7564         | 121          | 26740<br>9223                   | 35963                            | 1698664<br>1628051            | 4286408            | 263144                | 251170                     | 5982767                        | 1657088                            | 1299411<br>1299029                  | 4519813                                     | 5074<br>4326                     | 210434           | 1081.0  | 210370        | 1082.9 |
| STS-133 | 103<br>(39)        | 185336       | 6084                                    | 24861       | 1927     | 4971 | 228323                          | 30576<br>818                 | 0                   | 1949         | 408          | 31802<br>8306                   | 40108                            | 1729240<br>1629277            | 4326516            | 268461                | 254067                     | 6236834                        | 1657403                            | 1299112<br>1299345                  | 4525061                                     | 1431<br>394                      | 205075           | 1082.4  | 205022        | 1084.2 |
| STS-134 | 105<br>(25)        | 185638       | 7007                                    | 24860       | 1907     | 4973 | 229529                          | 30721<br>811                 | 0                   | 1609         | 161          | 31693<br>7517                   | 39210                            | 1759961<br>1630249            | 4365726            | 268769                | 256331                     | 6493165                        | 1657445                            | 1298824<br>1299313                  | 4525091                                     | 1968<br>3211                     | 204532           | 1080.4  | 204463        | 1082.3 |
| STS-135 | 104<br>(33)        | 184276       | 7072                                    | 24861       | 2171     | 4962 | 228486                          | 27997<br>2137                | 0                   | 24175        | 291          | 30425<br>7109                   | 37534                            | 1787958<br>1632677            | 4403260            | 266050                | 254325                     | 6747490                        | 1657525                            | 1298160<br>1298628                  | 4521103<br>4521103                          | 1987<br>N/A*                     | 226333           | 1090.7  | 226270        | 1092.4 |

\*Reconstruction analysis was not available (N/A) for STS-135 due to lack of funding.





## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES

The authors would like to acknowledge the following individuals for their contributions to the preparation of this book. Data Sources are also provided.

### **ACKNOWLEDGEMENTS - LEGLER INFORMAL BOOK**

To: Brewster H. Shaw, while COO of United Space Alliance, for his sponsorship of Legler's informal book.

To: Mary C. Thomas/DA8 for her dedicated services as Book Manager for Revisions and Change Notices to Bob Legler's informal book through flight STS-115.

To: Karen J. Chisholm/DA8 for her dedicated services as editor and typist for Revisions and Change Notices to Bob Legler's informal book through flight STS-115.

To: All those who helped Bob Legler gather data through flight STS-115.

### **DATA SOURCES - LEGLER INFORMAL BOOK**

This document provides "as flown" operational mission data and has been compiled from many sources including the following:

- Flight Logs
- Flight Rules
- Flight Anomaly Logs
- MOD Post-Flight Reports (Ascent, On-Orbit and Descent)
- Post Flight Analysis of MPS propellants
- FDRD - Flight Definition Requirements Document
- FRD - Flight Requirements Document
- SODB - Shuttle Operational Data Book
- MER (Mission Evaluation Room) Shuttle Flight Data.
- Orbit Distance traveled is taken from the PAO Mission Statistics.

### **ACKNOWLEDGEMENTS - BENNETT (STS-116 Through STS-135)**

To: James M. Heflin/AB111, Associate Center Director Technical, for his leadership role to publish the informal "Legler Book" as an official NASA Technical Memorandum.

To: USA's continued sponsorship to finalize the NASA Technical Memorandum.

To: Michael Curie, NASA HQs PAO Specialist & Commentator for his many responses to requests for information from Floyd Bennett.

To: M. Cathleen (Cat) Buehrer/DA32 (REDE CRITIQUE NSS JV) for her invaluable tutorial assistance and knowledge provided to Floyd Bennett for navigating through Microsoft Word software for preparation of this final book.

To: Edward P. Gonzalez/DM321 and John A. Fields/ DM111 for excellent technical review.

To: Dale H. Ward/IS4 (Tessada) and Sharon Hecht/IS4 (DB Consulting Group, Inc.) for their excellent editorial comments and final document preparation.

### **DATA SOURCES - FOR BENNETT**

And finally, thanks to all the Data Source Contributors who helped Floyd Bennett find his way to the correct mission data for flights STS-116 through STS-135.

See the listing to follow:



## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES (Continued)

This listing provides the data sources and Point(s) of Contact (POC's) used in preparing the portion of the Space Shuttle Mission Summary Book for missions STS-116 through STS-135. My thanks to all these contributors and many others who helped this author find his way to the correct mission data.

Floyd V. Bennett

| <u>ITEM</u>   | <u>DATA SOURCES</u>  |
|---|--|
| <u>COLUMN 1: FLT NUMBER</u>   |  |
| FLT NO.   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>                              |
| SEQ FLT #   | Calculated from previous missions  |
| KSC- #  | Calculated from previous missions at KSC   |
| PAD #   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>                              |
| PAD # (#)   | Calculated from previous missions same pad   |
| MLP-3   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>                              |
| # SHUTTLE<br>FLIGHT TO ISS  | Calculated from previous missions to ISS   |
| <u>COLUMN 2: ORBITER</u>  |  |
| ORBITER<br>Vehicle Designation<br>(Number of Flights)<br>Vehicle Name               | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>                              |
| OMS PODS<br>Left POD #, Right POD #,<br>& FWD RCS POD #<br># of Flights of each POD | MV/Orbiter Project Office, POC's: Dwyer, Kenneth J. (JSC-MV6) and Storm, Michael D. (KSC-USA)<br># of flights calculated from previous flight of the POD's |

## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES (Continued)

| <u>ITEM</u>  | <u>DATA SOURCES</u>   |
|--|---|
| <u>COLUMN 3: CREW SIZE, TITLE, NAMES, AND EVA'S</u>                    |   |
| FLIGHT CREW SIZE   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>   |
| FLIGHT CREW,<br>FLIGHT DIRECTORS,<br>& CAPCOMS<br>TITLES & NAMES       | DA8/Lead Flight Directors Memos & JSC PAO Mission Press Kit: <a href="http://www.shuttlepresskit.com">http://www.shuttlepresskit.com</a>  |
| EVA's<br>Type and Duration   | JSC PAO Shuttle Status Reports: <a href="http://www.nasa.gov/centers/johnson/news/shuttle/index.html">http://www.nasa.gov/centers/johnson/news/shuttle/index.html</a><br>MMT Briefings: John A. Mccullough, Annette P. Hasbrook, Norm Knight DA8                  |
| # of EVA's   | Calculated from previous mission EVAs   |
| <u>COLUMN 4: LAUNCH SITE, LIFTOFF TIME, LANDING SITES, ABORT TIMES</u> |   |
| LAUNCH SITE  |   |
| Launch Pad   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>   |
| Launch Date & Time   | Ascent FDO Post Flight Report/DM, POC's: Gonzalez, Edward P. Sparks, Carson W. (USA), & McDonald, Mark A. (USA)   |
| Day of Week (#)  | Refers to # of launches that day of week calculated from previous missions same day of week   |
| Date (#)   | Refers to # of launches that month calculated from previous missions same month   |
| LAUNCH WINDOW  | Real-time data, POC: Sparks, Carson W. and Mark McDonald (JSC-DM) [USA]   |
| EOM PLS  | Planned landing site: FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>   |
| TAL  | Ascent FDO Post Flight Report/DM, POC's: Gonzalez, Edward P. Sparks, Carson W. (USA), McDonald, Mark A. (USA), & Kalil, Jose G. (JSC-DM)[USA]   |
| TAX WX   | Spacecraft Meteorology Group Post Mission Summary, POC: Oram, Timothy D. (JSC-WS8) [NOAA]   |
| SELECTED:<br>RTLS, TAL, AOA, PLS                                       | LSO Post-Flight Summary, POC: Linde, Martin G. (JSC-DM) [USA] & Hensley, Doyle W. (JSC-DM461)   |
| MAX Q NAV  | STS-XXX GNC First Stage Reconstruction: <a href="https://sspweb.jsc.nasa.gov/webdata/sei/t_Post%20Flight%20Reports/">https://sspweb.jsc.nasa.gov/webdata/sei/t_Post%20Flight%20Reports/</a><br>POC's: Cooper, Carling C. (Boeing), and Biskup, Bruce A., (Boeing) |
| SRB STG: [MET]   | STS-XXX Ascent Performance Trajectory Reconstruction letter, POC: Stephen P. Brod/The Boeing Company (HM5-20)   |
| ALL REMAINING DATA<br>THIS COLUMN                                      | Ascent FDO Post Flight Report/DM, POC's: Gonzalez, Edward P. Sparks, Carson W. (USA), & McDonald, Mark A. (USA)   |



## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES (Continued)

| <u>ITEM</u>   | <u>DATA SOURCES</u>  |
|---|--|
| <u>COLUMN 5: LANDING SITE/RUNWAY, CROSSRANGE, LANDING TIMES, FLIGHT DURATION, WINDS</u> |  |
| ALL ITEMS EXCEPT<br>ENTRIES LISTED BELOW:   | Descent Postflight Summary & Quicklook Reports: <a href="http://usa1.unitedspacealliance.com/usahou/orgs/48-20/dsct/pf/">http://usa1.unitedspacealliance.com/usahou/orgs/48-20/dsct/pf/</a><br>POC: Barbara Schill (USA) & Chris Re (USA), Chris Lessman (USA), Rosalyn Mark |
| LANDING EVENTS  |  |
| Time of Landing   | Image Science & Analysis group: <a href="http://isal-web1.jsc.nasa.gov/Shuttle/ShowPage.pl?template=default.htm">http://isal-web1.jsc.nasa.gov/Shuttle/ShowPage.pl?template=default.htm</a><br>Ascent/Descent Flight Design, POC: Lessmann, Christopher F. (USA)             |
| Site (#)  | Site (#) refers to # of landings at a site, calculated from previous landing at that site  |
| Surface (#)   | Surface (#) refers to # of landings on surface from previous landings on same surface  |
| Landing Day of Week (#)   | (#) refers to # of landings on that particular weekday, calculated from landings on same weekday   |
| Landing Date (#)  | (#) refers to # of landings in a particular calendar month, calculated from landings in the same calendar month  |
| DEORBIT BURN  | GMT (e.g., 051:12:59:52.0Z)-DM Trajectory Server - Legler Report, POC's: Propst, Carolyn A. (USA) & Deboeck, Toni F (USA)  |
| ORBIT DIR   | (#) refers to # of landings from the same direction, calculated from # of last mission at same direction   |
| TIME OF EVENTS<br>DURING LANDING  | LLIMS Events: <a href="http://isal-web1.jsc.nasa.gov/llims/ObservationPublic.aspx?Mode=screening&amp;mission=STS-XXX">http://isal-web1.jsc.nasa.gov/llims/ObservationPublic.aspx?Mode=screening&amp;mission=STS-XXX</a>  |
| ROLLOUT   |  |
| Distance (ft)   | Calculated: wheels stop position - MLGTD position  |
| Time (sec)  | Calculated: wheels stop GMT - MLGTD GMT  |
| WINDS: OFFICIAL<br>and DENS ALT (ft)  | Spaceflight Meteorology Post Flight Mission Summary, POC: Oram, Timothy D. (JSC-WS8) [NOAA]  |
| FLT DURATION  |  |
| S/T   | Shuttle total flight time, calculated: mission duration + sum of previous missions   |
| OV-XXX:   | Total flight time for specific orbiter vehicle, calculated: mission duration + sum of previous missions  |
| DISTANCE  | Statute miles traveled this mission: PAO Missions Stats Report, POC: Herring, Kyle J. (JSC-AP311)  |
| TOTAL SHUTTLE DISTANCE  | Calculated: distance traveled this mission + sum of previous missions<br>PAO Missions Stats Report, POC: Herring, Kyle J. (JSC-AP311)  |

## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES (Continued)

| <u>ITEM</u>   | <u>DATA SOURCES</u>  |
|---|--|
| <u>COLUMN 6: SSME-TL, NOM-ABORT, EMERG THROTTLE PROFILE</u> |  |
| SSME THROTTLE LEVELS  |  |
| PREDICTED   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>  |
| ACTUAL  | Ascent FDO Post Flight Report/DM, POC's: Gonzalez, Edward P. Sparks, Carson W. (USA), & McDonald, Mark A. (USA)  |
| ENG. S.N.<br>(#)  | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a><br>Refers to # of flights by engine serial number - calculated from previous flight by that SSME |
| M 3 EOM and LANDING<br>WEIGHT and X CG                      | IDP Cycle/Prop30 Aerosciences Report/Version 01, POC: Schill, Barbara C. (USA)   |
| <u>COLUMN 7: SRB, RSRM, AND ET</u>                          |  |
| SRB, RSRM, and ET   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>  |
| ET IMPACT: MET, LAT, LONG                                   | STS-XXX Nominal ET Disposal Chart and ET Summary Table, POC: Dulski, Matthew B. (USA) & Strach, Daniel P (USA)   |
| <u>COLUMN 8: ORBIT INCLINATION</u>                          |  |
| INC   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>  |
| <u>COLUMN 9: ORBIT HA/HP</u>                                |  |
| INSERTION (type)  | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>  |
| POST OMS-2 (nm) and<br>DEORBIT HA/HP                        | DM Trajectory Server - Legler Report Request, POC's: Propst, Carolyn A. (USA), Deboeck, Toni F (USA), and Leleux, Darrin P. (JSC-DM411)  |
| ENTRY VELOCITY (fps) and<br>ENTRY RANGE (nm)                | Descent Post Flight Summary: <a href="http://usa1.unitedspacealliance.com/usahou/orgs/48-20/dsct/pf/">http://usa1.unitedspacealliance.com/usahou/orgs/48-20/dsct/pf/</a> , POC: Hill, Trudy D. (Debbie) (USA)                  |



## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES (Continued)

| <u>ITEM</u> | <u>DATA SOURCES</u> |
|-------------|---------------------|
|-------------|---------------------|

### COLUMN 10: FLIGHT SOFTWARE (FSW)

|              |   |
|--------------|---|
| OI-XX<br>(#) | Orbit Insertion Flight Software version # - FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a><br>(#) refers to # of flights flown - calculated from last flight of that FSW version |
|--------------|---|

### COLUMN 11: PAYLOAD WEIGHTS; PAYLOADS, EXPERIMENTS

|   |   |
|---|---|
| PAYLOAD WEIGHTS<br>TOTAL, MIDDECK,<br>DEPLOYED, and<br>NON-DEPLOYED | Day of Launch (DOL) Trajectory Design Data Package (TDDP), POC: Bhula, Jayantilal (Jay) (USA) |
|---|---|

|  |  |
|--|--|
| SHUTTLEACCUMULATED<br>WEIGHTS<br>DEPLOYED,<br>NON-DEPLOYED,<br>and CARGO TOTAL | Calculated (summed) from previous missions |
|--|--|

|   |   |
|---|---|
| PERFORMANCE MARGIN (LBS)<br>FPR and FUEL BIAS,<br>FINAL TDDP<br>RECON | Day of Launch (DOL) Trajectory Design Data Package (TDDP), POC's: Bhula, Jayantilal (Jay) (USA)<br>Provided by Mike . L. Scott/USA/FDD POC<br>STS-XXX Ascent Performance Trajectory Reconstruction, POC:Steven P. Brod/Boeing |
|---|---|

|   |   |
|---|---|
| ASSIGNMENTS<br>PAYLOADS: PLB and MIDDECK<br># CRYO TANK SETS<br>STS OPERATOR SELECTIONS | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a> |
|---|---|

|         |  |
|---------|--|
| RMS (#) | -# of flights RMS flown - calculated from previous missions with RMS |
|---------|--|

## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES (Continued)

| <u>ITEM</u>                          | <u>DATA SOURCES</u>  |
|--------------------------------------|--|
| <u>COLUMN 12: MISSION HIGHLIGHTS</u> |  |
| BRIEF MISSION SUMMARY                | JSC PAO Mission Press Kit: <a href="http://www.shuttlepresskit.com/">http://www.shuttlepresskit.com/</a><br>MMT Minutes: <a href="https://sspweb.jsc.nasa.gov/mmt/">https://sspweb.jsc.nasa.gov/mmt/</a>   |
| KSC W/D (Work Days)                  | KSC Milestone Interface Chart, POC: Overton, Thomas L. (KSC) [ASRC AEROSPACE] & Clark D. Ford (KSC PHO00)  |
| LAUNCH POSTPONEMENTS                 | SSPO PRCB Directives: <a href="https://sspweb.jsc.nasa.gov/meeting/mtgdata.cfm">https://sspweb.jsc.nasa.gov/meeting/mtgdata.cfm</a>  |
| LAUNCH SCRUBS                        | MMT Minutes: <a href="https://sspweb.jsc.nasa.gov/mmt/">https://sspweb.jsc.nasa.gov/mmt/</a>   |
| LAUNCH WINDOW                        | Real-time Data, POC: Sparks, Carson W. (JSC-DM) [USA]  |
| LAUNCH DELAYS                        | MMT Minutes: <a href="https://sspweb.jsc.nasa.gov/mmt/">https://sspweb.jsc.nasa.gov/mmt/</a>   |
| TAL WEATHER                          | Spaceflight Meteorology Group Post Mission Summary,<br><a href="http://www.srh.noaa.gov/smg/XXX_Postmission_Summary.pdf">http://www.srh.noaa.gov/smg/XXX_Postmission_Summary.pdf</a> (XXX is STS Flight #)<br>POC: Oram, Timothy D. (JSC-WS8) [NOAA] |
| PERFORMANCE<br>ENHANCEMENTS          | Day of Launch (DOL) Trajectory Design Data Package (TDDP), POC: Bhula, Jayantilal (Jay) (USA)  |
| FLIGHT DURATION<br>CHANGES/LANDING   | MMT Minutes: <a href="https://sspweb.jsc.nasa.gov/mmt/">https://sspweb.jsc.nasa.gov/mmt/</a><br>Spaceflight Meteorology Group Post Mission Summary, POC: Oram, Timothy D. (JSC-WS8) [NOAA]   |
| FIRSTS/LASTS                         | JSC PAO Mission Press Kit: <a href="http://www.shuttlepresskit.com/">http://www.shuttlepresskit.com/</a><br>Flight Readiness Reviews: <a href="https://sspweb.jsc.nasa.gov/webdata/launch/">https://sspweb.jsc.nasa.gov/webdata/launch/</a>          |
| NIGHT LAUNCH (#)                     | Number of night launches, calculated from previous night launch mission  |
| NIGHT LANDING (Site, #)              | Number of night landings at specified site, calculated from previous night landing mission at that site  |
| RENDEZVOUS                           | Number of rendezvous missions, calculated from previous rendezvous mission   |

Continued...



## APPENDIX B - ACKNOWLEDGEMENTS AND DATA SOURCES (Continued)

| <u>ITEM</u>  | <u>DATA SOURCES</u>   |
|--|---|
| <u>COLUMN 12 MISSION HIGHLIGHTS</u> (Continued)    |   |
| <u>EVENTS</u>                                      |   |
| Time of on-orbit maneuver events (OMS 2, IT, etc.) | DM Trajectory Server - Legler Report, POC's: Propst, Carolyn A. (USA) and Deboeck, Toni F (USA)   |
| Time of docking/undocking events                   | APDS sensor Data from the ODRC, POC: Dake, Janna J., Murphy, Rachel & Haskovec, Doug (JSC-DS421)  |
| Time of ISS hatch opening and crew welcome         | JSC PAO Shuttle Status Reports: <a href="http://www.nasa.gov/centers/johnson/news/shuttle/index.html">http://www.nasa.gov/centers/johnson/news/shuttle/index.html</a>   |
| EVA descriptions and durations                     | Post flight EVA notes (provided by DX POC)<br>JSC PAO Shuttle Status Reports: <a href="http://www.nasa.gov/centers/johnson/news/shuttle/index.html">http://www.nasa.gov/centers/johnson/news/shuttle/index.html</a> |
| Transfers (hardware and consumables weights)       | STS-XXX Final Customer Support Room (CSR) Report and STS-XXX Mission by the Numbers (provided by MO POC's)  |
| SIGNIFICANT ANOMALIES                              | PCASS In-flight Anomalies: <a href="https://usa93.usa-spaceops.com:4443/adamvweb/ifa.ifa_search2.wp_execfind">https://usa93.usa-spaceops.com:4443/adamvweb/ifa.ifa_search2.wp_execfind</a>                          |
| ENTRY BLACKOUT                                     | INCO Electronic Flight Log (Provided by DS POC Steve Sides & Mark Williamson)   |
| <u>WEIGHT SUMMARY</u>                              |   |
| All entries except entries below:                  | Day of Launch (DOL) Trajectory Design Data Package (TDDP): POC: Bhula, Jayantilal (Jay)/USA   |
| Orbiter Tail No.                                   | FDRD: <a href="https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm">https://sspweb.jsc.nasa.gov/webdata/pdcweb/07700.htm</a>   |
| Shuttle /PL Accumulated WTs                        | Calculated from previous missions   |
| Weight at Orbit Insertion                          | Ascent Post Flight Data (provided by Gonzalez, Edward P./JSC-DM)  |
| Performance Margin                                 |   |
| Final TDDP   | Provided by Mike . L. Scott/USA/FDD POC   |
| Reconstructed                                      | STS-XXX Ascent Performance Trajectory Reconstruction (Kristin Smaltz & Stephen Brod/Boeing)   |
| Orbiter weight at Mach 3 EOM and at Landing        | IDP Cycle/Prop30 Aerosciences Report (provided by Barbara Shill & Rosalyn Mark/USA/FDD/SDM)   |
| <u>PHOTOS (All Missions)</u>                       | Identified by NASA Number, unless otherwise noted. POC: Jody Russell/JSC-AP (Tessada)   |

## APPENDIX C - FLIGHT DIRECTOR LOG

This appendix provides the JSC Flight Director Log initially compiled and kept updated by Bob Legler, “History Flight”. Since his death the log has been maintained by the Flight Director Office staff. This is a listing of Flight Directors beginning with Christopher C. Kraft, Jr. “Red Flight” in 1960 with Project Mercury flights, and ending with the completion of the Space Shuttle Program in 2011.

Note: Names listed in blue denote photo available from electronic copy by “control-hold-click”.



| <b>FLIGHT DIRECTOR LOG</b><br>(August 2010)<br><i>Compiled by HISTORY FLIGHT and updated by DA8 Staff</i> |                                |                                    |        |                 |                        |                              |
|---|--------------------------------|------------------------------------|--------|-----------------|------------------------|------------------------------|
| #   | COLOR                          | NAME                               | CLASS  | STATUS          | First Shift on Console | Retired as a Flight Director |
| 1   | Red Flight                     | Christopher C. Kraft               | 1960   | Retired         |                        | 1967                         |
| 2   | Blue Flight                    | John Hodge                         | 1963   | Retired         |                        |                              |
| 3   | White Flight                   | Eugene F. Kranz                    | 1963   | Retired         |                        | 1974                         |
| 4*  | Black Flight                   | Glynn S. Lunney                    | 1963   | Retired         |                        |                              |
| 5   | Green Flight                   | Clifford E. Charlesworth           | 1966   | Deceased - 2001 |                        | 1970                         |
| 6   | Gold Flight                    | Gerald D. Griffin                  | 1968   | Retired         |                        | 1973                         |
| 7   | Maroon Flight                  | Milton L. Windler                  | 1968   | Retired         |                        |                              |
| 8   | Orange Flight                  | M. P. (Pete) Frank                 | 1968   | Deceased - 2005 |                        | 1983                         |
| 9   | Purple Flight                  | Phillip C. Shaffer                 | 1971   | Deceased - 2007 |                        | 1974                         |
| 10  | Crimson Flight                 | Donald R. Puddy (STS-1)            | 1971   | Deceased - 2007 |                        | 1981                         |
| 11  | Silver Flight                  | Neil B. Hutchinson (STS-1)         | 1971   | Retired         |                        | 1984                         |
| 12  | Bronze Flight                  | Charles R. Lewis (STS-1)           | 1971   | Retired         |                        | 1984                         |
| 13  | Ivory Flight                   | Tommy W. Holloway                  | 1979   | Retired         |                        | 1984                         |
| 14  | Crystal Flight                 | Harold M. Draughon                 | 1979   | Retired         |                        | 1984                         |
| 15  | Gray Flight                    | Gary E. Coen                       | May-81 | Retired         |                        | 1995                         |
| 16  | Granite Flight                 | John T. Cox                        | May-81 | Retired         |                        | 1988                         |
| 17  | Emerald Flight                 | Jay H. Greene                      | May-81 | Retired         |                        | 1987                         |
| 18  | Amber Flight                   | Brock (Randy) Stone                | Nov-81 | Retired         |                        | 1993                         |
| 19  | Indigo Flight                  | Lawrence S. Bourgeois              | Nov-81 | Retired         |                        | 1991                         |
| 20  | Aquila Flight                  | A. (Lee) Briscoe                   | Mar-83 | Retired         |                        | 1991                         |
| 21  | Orion Flight                   | T. Cleon Lacefield                 | Mar-83 | Retired         |                        | 1986                         |
| 22  | <a href="#">Polaris Flight</a> | Granvil A. Pennington              | Mar-83 | Retired         |                        | 2007                         |
| 23  | Alpha Flight                   | William D. Reeves                  | Mar-83 | Retired         |                        | 2001                         |
| 24  | Altair Flight                  | Charles W. Shaw                    | Mar-83 | Retired         |                        | 2003                         |
| 25  | Sirius Flight                  | J. Milton Heflin, Jr.              | Mar-83 | Retired         |                        | 2005                         |
| 26  | Rigel Flight                   | Charles R. Knarr                   | Mar-83 | Retired         |                        | 1991                         |
| 27  | Phoenix Flight                 | Ronald D. Dittmore                 | Nov-85 | Retired         |                        | 1992                         |
| 28  | Turquoise Flight               | N. Wayne Hale, Jr.                 | Feb-88 | Retired         |                        | 2004                         |
| 29  | Antares Flight                 | Robert E. Castle, Jr.              | Feb-88 | Retired         |                        | 2003                         |
| 30  | Falcon Flight                  | Robert M. Kelso                    | Feb-88 | Retired         |                        | 2000                         |
| 31  | Regulus Flight                 | <a href="#">Philip L. Engelauf</a> | Dec-89 | Retired         |                        | 2008                         |
| 32  | Aurora Flight                  | Jeffrey W. Bantle                  | Dec-89 | Retired         |                        | 2001                         |
| 33  | Corona Flight                  | Linda J. (Hautzinger) Ham          | Jan-91 | Retired         |                        | 2000                         |
| 34  | Burgundy Flight                | Richard D. Jackson, Jr.            | Jan-91 | Retired         |                        | 1997                         |
| 35  | Kitty Hawk Flight              | John F. Muratore                   | Jan-92 | Retired         |                        | 1994                         |
| 36  | <a href="#">Iron Flight</a>    | <a href="#">Paul F. Dye</a>        | Nov-93 |                 |                        |                              |
| 37  | Perseus Flight                 | Bryan P. Austin                    | Nov-93 | Retired         |                        | 2003                         |
| 38  | Midnight Flight                | John P. Shannon                    | Nov-93 | Retired         |                        | 2004                         |
| 39  | Argon Flight                   | <a href="#">Andrew F. Algate</a>   | Oct-94 | Retired         |                        | 2008                         |
| Continued...  |                                |                                    |        |                 |                        |                              |

| <b>FLIGHT DIRECTOR LOG</b><br>(August 2010)<br><i>Compiled by HISTORY FLIGHT and updated by DA8 Staff</i><br>(Continued...) |                        |  |         |           |                        |                              |
|---|------------------------|--|---------|-----------|------------------------|------------------------------|
| #   | COLOR                  | NAME                                     | CLASS   | STATUS    | First Shift on Console | Retired as a Flight Director |
| 40  | <i>Atlas Flight</i>    | Paul S. Hill                             | Jun-96  | Retired   |                        | 2005                         |
| 41  | <i>Ares Flight</i>     | Jeffrey M. Hanley                        | Jun-96  | Retired   |                        | 2005                         |
| 42  | <i>Cardinal Flight</i> | <a href="#">Mark A. Kirasich</a>         | Jun-96  | Retired   |                        | 2006                         |
| 43  | <i>Cassini Flight</i>  | <a href="#">Sally P. Davis</a>           | Jun-96  | Retired   |                        | 2008                         |
| 44  | <i>Azure Flight</i>    | <a href="#">Mark J. Ferring</a>          | Jun-96  | Retired   |                        | 2007                         |
| 45  | <i>Arcturus Flight</i> | <a href="#">John M. Curry</a>            | Jun-98  | Retired   |                        | 2007                         |
| 46  | <i>Pegasus Flight</i>  | <a href="#">Richard E. La Brode, Jr.</a> | Jun-98  |           |                        |                              |
| 47  | <i>Chromium Flight</i> | Leroy E. Cain                            | Jun-98  | Retired   |                        | 2005                         |
| 48  | <i>Sapphire Flight</i> | <a href="#">Kelly B. Beck</a>            | Jun-98  | Retired   |                        | 2008                         |
| 49  | <i>Flash Flight</i>    | Joel R. Montalbano                       | Oct-00  | Retired   |                        | 2008                         |
| 50  | <i>Eagle Flight</i>    | <a href="#">John A. McCullough</a>       | Oct-00  |           |                        |                              |
| 51  | <i>Amethyst Flight</i> | <a href="#">Norman D. Knight</a>         | Oct-00  |           |                        |                              |
| 52  | <i>Fuchsia Flight</i>  | <a href="#">Annette P. Hasbrook</a>      | Oct-00  | Retired   |                        | 2009                         |
| 53  | <i>Titanium Flight</i> | <a href="#">J. Derek Hassmann</a>        | Oct-00  |           |                        |                              |
| 54*   | <i>Onyx Flight</i>     | <a href="#">Bryan C. Lunney</a>          | Oct-00  | [Retired] |                        | [2011]                       |
| 55  | <i>Aquarius Flight</i> | <a href="#">Matthew R. Abbott</a>        | Oct-00  |           |                        |                              |
| 56  | <i>Topaz Flight</i>    | <a href="#">Catherine A. Koerner</a>     | Oct-00  | Retired   |                        | 2007                         |
| 57  | <i>Intrepid Flight</i> | <a href="#">Anthony J. Ceccacci</a>      | Oct-00  |           |                        |                              |
| 58  | <i>Garnet Flight</i>   | <a href="#">Steven J. Stich</a>          | Oct-00  | Retired   |                        | 2007                         |
| 59  | <i>Defiant Flight</i>  | <a href="#">Kwatsi Alibaruho</a>         | Feb-05  |           |                        |                              |
| 60  | <i>Vega Flight</i>     | <a href="#">Ginger Kerrick</a>           | Feb-05  |           |                        |                              |
| 61  | <i>Galileo Flight</i>  | <a href="#">Robert Dempsey</a>           | Feb-05  |           |                        |                              |
| 62  | <i>Viking Flight</i>   | <a href="#">Holly Ridings</a>            | Feb-05  |           |                        |                              |
| 63  | <i>Mercury Flight</i>  | <a href="#">Dana Weigel</a>              | Feb-05  |           | 01/16/06               |                              |
| 64  | <i>Liberty Flight</i>  | <a href="#">Brian Smith</a>              | Feb-05  |           | 02/13/06               |                              |
| 65  | <i>Sigma Flight</i>    | <a href="#">Richard Jones</a>            | Feb-05  |           | 06/30/06               |                              |
| 66  | <i>Kodiak Flight</i>   | <a href="#">Michael Sarafin</a>          | Feb-05  |           | 07/13/06               |                              |
| 67  | <i>Apex Flight</i>     | <a href="#">Michael Moses</a>            | Feb-05  | Retired   | 09/05/06               | 2008                         |
| 68  | <i>Sequoia Flight</i>  | <a href="#">Heather Rarick</a>           | June-06 |           | 02/26/07               |                              |
| 69  | <i>Gemini Flight</i>   | <a href="#">Ron Spencer</a>              | June-06 |           | 04/23/07               |                              |
| 70  | <i>Peridot Flight</i>  | <a href="#">Emily J. Nelson</a>          | 2007    |           | 12/03/07               |                              |
| 71  | <i>Tranquility</i>     | <a href="#">Courtenay McMillan</a>       | 2007    |           | 12/07/07               |                              |
| 72  | <i>Odyssey Flight</i>  | <a href="#">David Korth</a>              | 2007    |           | 3/31/08                |                              |
| 73  | <i>Venture Flight</i>  | <a href="#">J. Chris Edelen</a>          | 2007    |           | 4/11/08                |                              |
| 74  | <i>Tungsten Flight</i> | <a href="#">Royce J. Renfrew</a>         | 2008    |           | 10/31/08               |                              |
| 75  | <i>Raptor Flight</i>   | <a href="#">Jerry P. Jason</a>           | 2008    |           | 4/14/09                |                              |
| 76  | <i>Viper Flight</i>    | <a href="#">Gary C. Horlacher</a>        | 2008    |           | 7/16/09                |                              |
| 77  | <i>Saturn Flight</i>   | <a href="#">Michael L. Lammers</a>       | 2008    |           | 7/11/09                |                              |
| 78  | <i>Carbon Flight</i>   | <a href="#">Edward A. Van Cise</a>       | 2009    |           | 1/20/10                |                              |
| 79  | <i>Keystone Flight</i> | <a href="#">Scott Stover</a>             | 2009    |           | 3/29/10                |                              |
| 80  | <i>Steel Flight</i>    | <a href="#">Dina Contella</a>            | 2009    |           | 5/10/10                |                              |

\* Second generation FDs, #4 Glynn Lunney and #54 Bryan Lunney

NOTE: There were two additional individuals that were selected as flight directors but elected to not continue: Rick Fitts and Michele Brekke.  
Continued...



| HONORARY FLIGHT DIRECTORS |                       |                         |                        |
|---------------------------|-----------------------|-------------------------|------------------------|
|                           | <i>COLOR</i>          | <i>NAME</i>             | <i>STATUS</i>          |
| <b>1</b>                  | <i>Grey Flight</i>    | Howard W. Tindall, Jr.  | Deceased - 1995        |
| <b>2</b>                  | <i>Pink Flight</i>    | Lois Ransdell           | Deceased - 1996        |
| <b>3</b>                  | <i>Diamond Flight</i> | Alene Ganzer            |                        |
| <b>4</b>                  | <i>Scarlet Flight</i> | John W. O'Neill         |                        |
| <b>5</b>                  | <i>History Flight</i> | <b>Robert D. Legler</b> | <b>Deceased - 2007</b> |

***THE FLIGHT DIRECTOR OFFICE:*** “Provides leadership and direction for conducting human space flight operation. Our mission is to ensure excellence in mission operations for Human Space Flight.” (DA8 Home Page)

# *IN MEMORIAM*



*Bob Legler*  
*April 4, 1927 - March 16, 2007*

Bob Legler, the originator of the informal Space Shuttle Missions Summary Book, was born a natural Corn Husker and lived a full life. His true love was serving his country in the US Coast Guard, Merchant Marines, United Nations, US Army, and the NASA Space Programs as an aerospace engineer. As one of a handful of people to ever support the Mercury, Gemini, Apollo, Skylab, Space Shuttle, and International Space Station missions, Bob was an icon to his peers. He spent 44 years in this noble endeavor called manned space flight. In the memorial service for Bob, Milt Heflin, JSC Associate Director and former JSC Chief Flight Director, provided the following insight:

“Bob was about making things happen, no matter what his position or rank, in whatever the enterprise was at that time...it might have been dodging bullets and bombs while establishing communication systems for United Nations outposts in crazy places...it might have been while riding the Coastal Sentry Quebec Tracking ship in the Indian Ocean...watching over the Lunar Module electrical power system or the operation of the Apollo Telescope Mount...serving as a SPAN Manager in the MCC (where a lot of really good stories were told during crew sleep)...or even while serving as the Chairman of the Annual FOD Chili Cook-off or his beloved Chairmanship of the Apollo Flight Operations Association [for reunions]...in each case he gave of himself so that the “mission,” no matter what it was, could be successful...Bob might not have been the most efficient chairman...story telling could get in the way from time to time...but he made up for it by being a catalyst, causing the team to rise to the occasion...

(Continued)



# IN MEMORIAM

( Continued)

And, we all know quite well his love of capturing the history of manned space flight...Apollo reunions and producing the Space Shuttle Missions Summary Book are two of his legacies...events and things with Bob's hands that were done for the enjoyment of all...he took great pride in keeping the "official" Flight Director Log, a listing of those that have served as a Flight Director in Mission Control...the Log today lists 69 Flight Directors beginning with Red Flight, Chris Kraft...even I had a hard time in convincing Bob that I would not abuse my electronic copy of this list, if he would just send it to me...this list also contains the names of only five individuals designated as an Honorary Flight Director...Bob is number 5, known as 'History Flight,' given that honor upon his retirement..."

From Randy Stone, former JSC Chief Flight Director and former JSC Deputy Director: "Bob mentored all of the new Flight Controller's with his wisdom, knowledge, but more importantly his passion for human space flight."

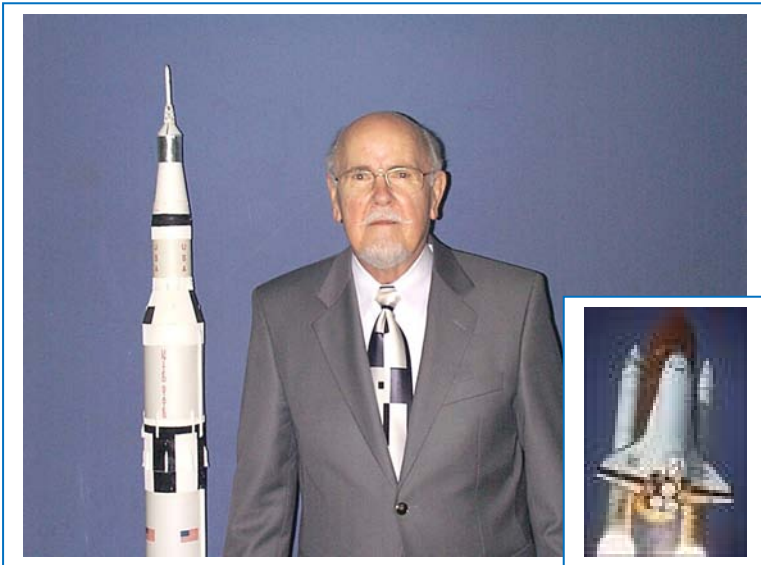
Others commented: "Bob was a walking encyclopedia of space knowledge and also had a great sense of humor." "Bob was a rarity in the annals of human space flight – a joyful cheerleader [with] unabashed love of the space program." "I could always rely on Bob for hard to find info. His enthusiasm for his work was obvious." "Bob was good natured and enjoyed a good joke, even if it was on him. I love Bob and will miss him."

And, shortly before Bob died, he received the following note from Bob Cabana, KSC Center Director and former Astronaut: "Bob, I look forward to your Summary Shuttle Book after the last [final] Shuttle mission. I think it's the only way I'm ever going to remember what missions I CAPCOM'ed on and who was on console with me."

The detail, the accuracy, the completeness of this Space Shuttle Missions Summary Book are a testament to Bob Legler's "passion and knowledge" for human space flight. We will finish this book for him with the same dedication.

*Floyd Bennett*  
*Friend & Colleague*

## ABOUT THE SECOND AUTHOR - FLOYD V. BENNETT



After Bob Legler's death in 2007, Floyd Bennett asked for and was given the task of completing Bob Legler's Space Shuttle Missions Summary Book, beginning with flight STS-116 and ending with the final Space Shuttle Mission. He was a friend and colleague of Bob's during the Apollo and Space Shuttle Programs. He also worked with Bob as a member of the Apollo Flight Operations Association for reunion events and was a co-author of Bob's 35th [and last] Apollo Anniversary Reunion Book.

Floyd has 57 years of technical and managerial experience in the field of Aerospace Engineering. After graduation from Virginia Tech University in 1954, he joined the National Advisory Committee for Aeronautics (which became NASA in 1958) at Langley Research Center in Hampton, VA. As a research engineer he published several NACA/NASA

Technical Reports on aircraft aeroelasticity. In 1962 he transferred with the Space Task Group to the Manned Spacecraft Center (now Johnson Space Center) in Houston, TX. Here he performed and managed analyses for manned spaceflight in engineering development, mission planning, flight operations, systems integration, and finally as a Space Shuttle Missions historian.

He performed key roles during the Apollo Program in establishing the Lunar Module Spacecraft landing and ascent operational trajectory strategies, lunar landing site selection, mission planning and real-time mission support for all Apollo manned lunar landing missions. During the Space Shuttle Program he performed a key role in systems integration for establishing program control of vehicle weight and performance for initial Space Shuttle manned development flights.

After NASA retirement in 1982 he continued making contributions in Space Shuttle Systems Integration for resolution of Payload, SSME, and Orbiter technical issues while working for three different NASA contractors, retiring from United Space Alliance in 2006.

Floyd is an Associate Fellow & Emeritus Lifetime Member American Institute of Aeronautics & Astronautics. He has received numerous NASA and USA awards for exceptional service during the Apollo and Space Shuttle Programs including an Apollo 15 Astronaut's Lunar Landmark named "Bennett Hill".









---